CORE PRODUCTS

SIGNAL PROCESSING AND CONVERSION

(SP&C)

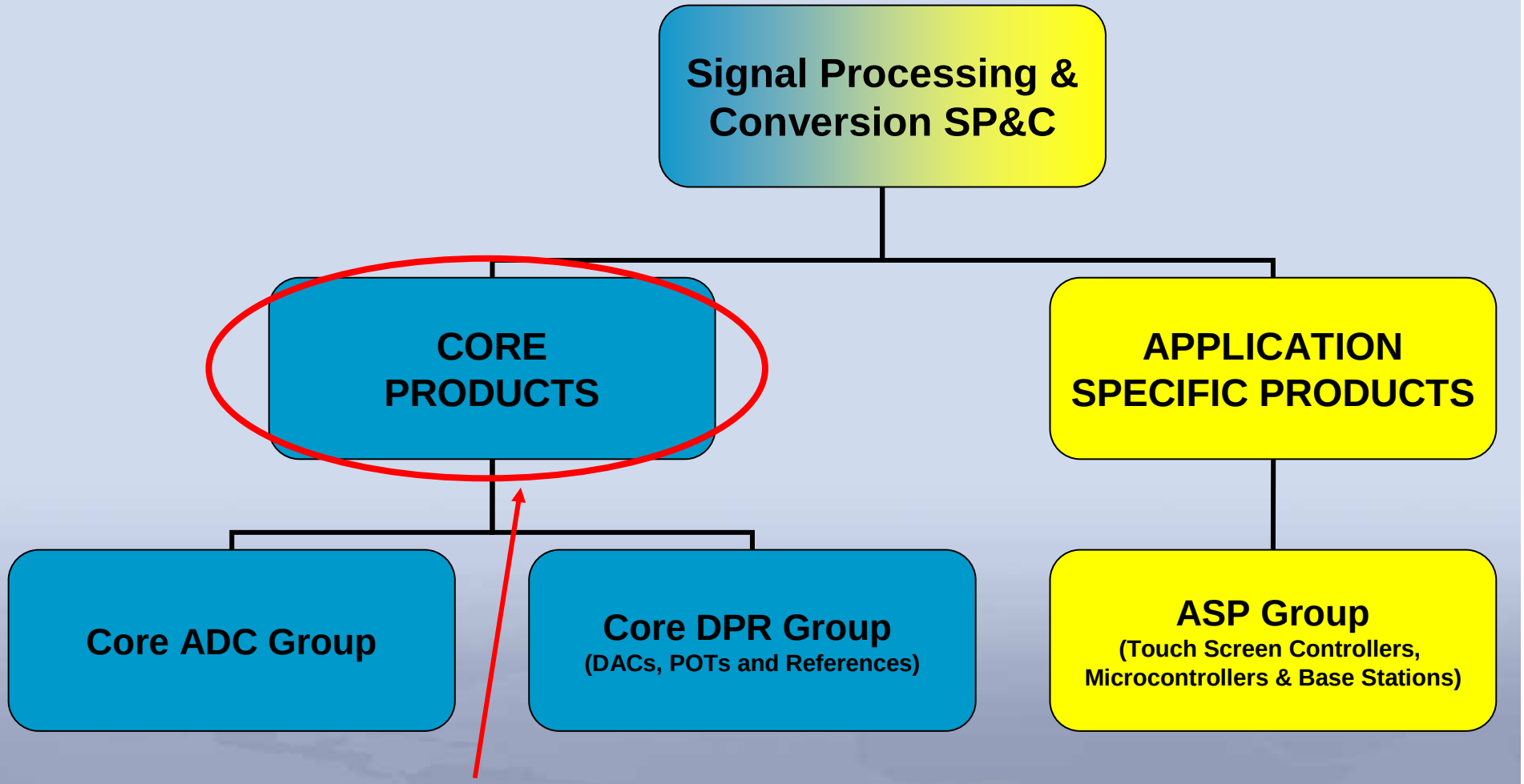
Dave Fry Silica Nordic Tour Feb 2009

david.fry@maxim-ic.com

Agenda

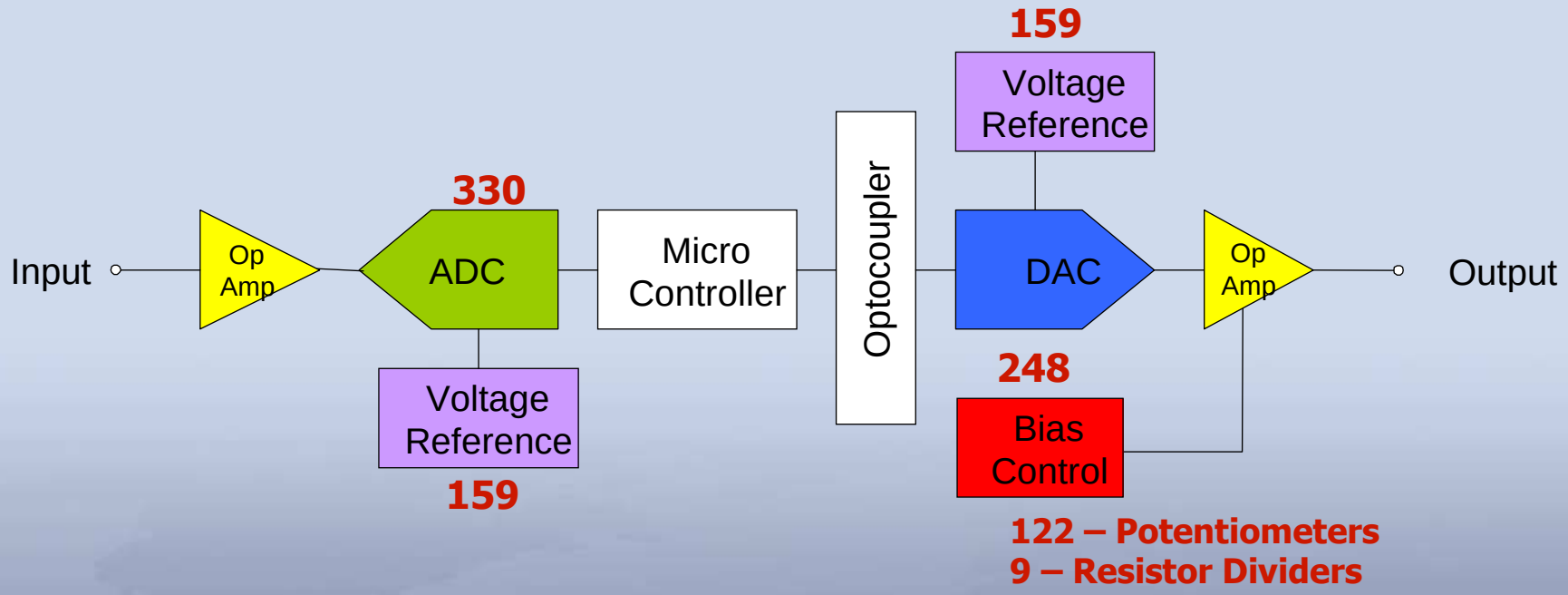
- Core Products
  - Precision ADCs
  - Precision DACs
  - Digital Pots
  - Voltage References
  - Precision Voltage Dividers (including the zero transistor ICs)
- Design Examples: Trading off the Error Budget in DAC & References Applications

SP&C ORGANIZATION



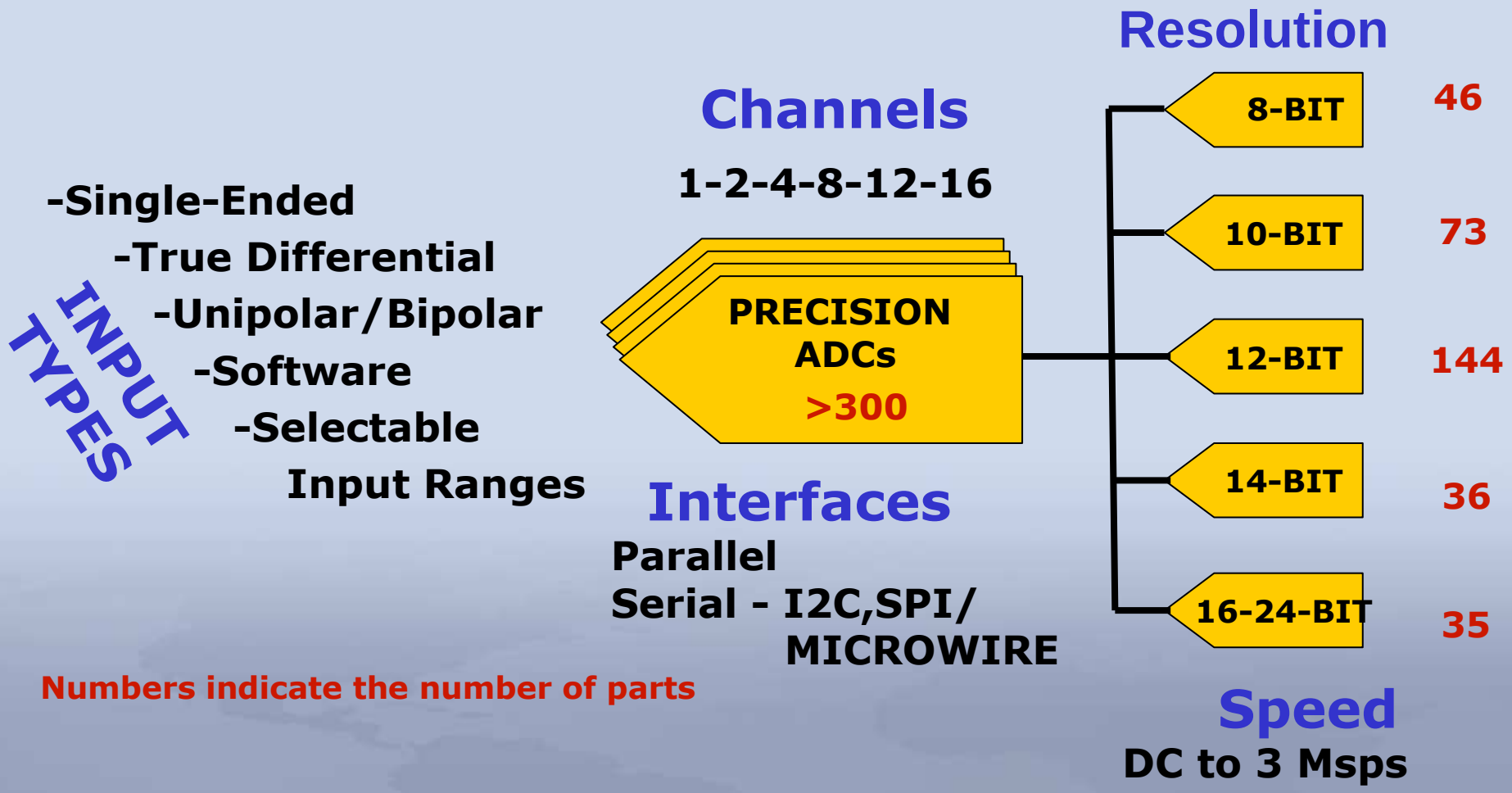
This presentation will focus on Core products
– Precision DACs, Precision ADCs, Digital Potentiometers, and References

CORE CONVERTER PRODUCTS
How do we fit in the Signal Chain?



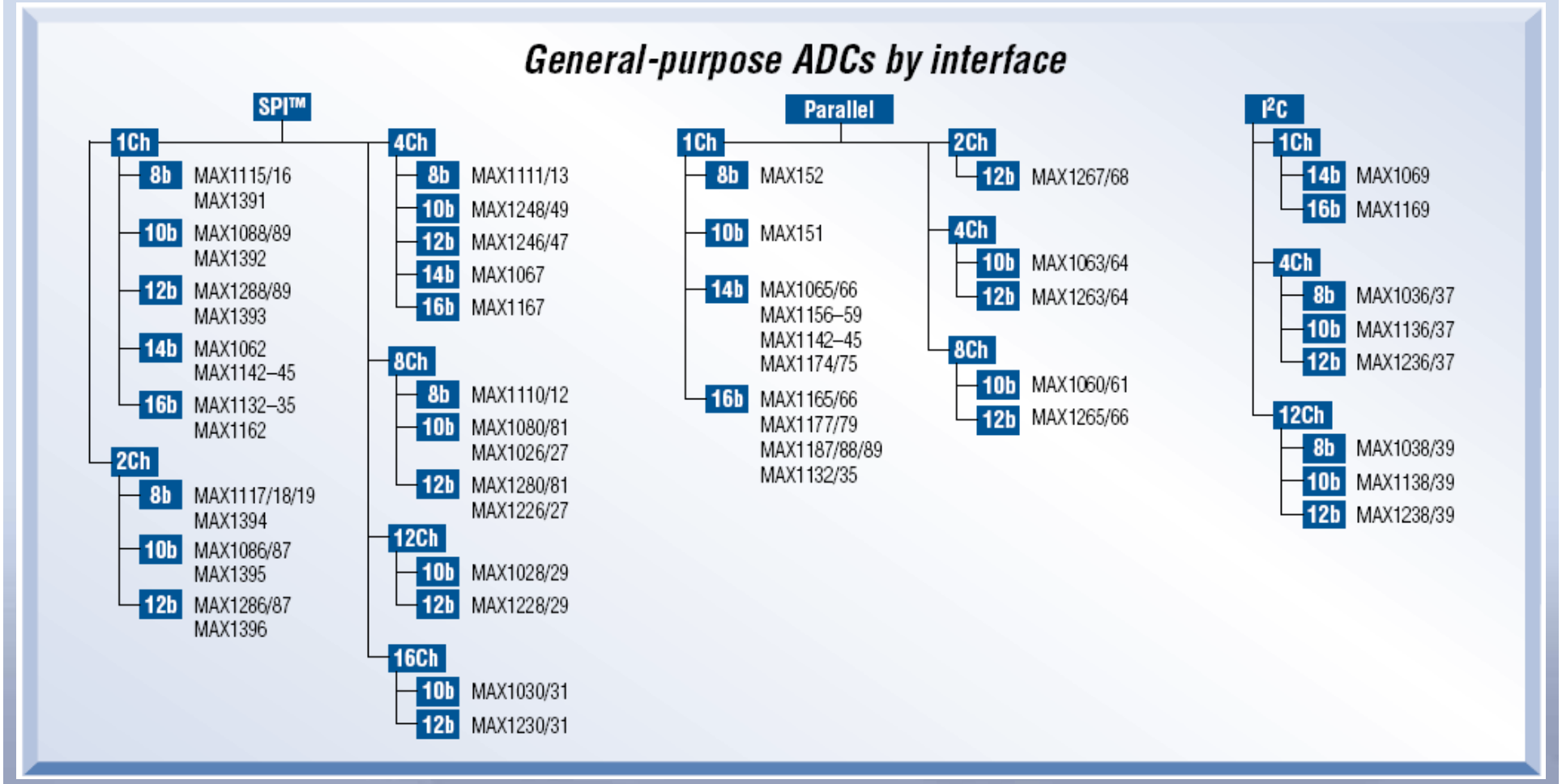
MAXIM

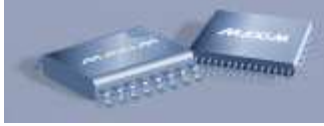
CORE PRODUCTS
LARGEST SELECTION OF ADC PARTS



– >300 root part numbers with 4000 combination parts

ADC Quick Reference Guide





MAXIM

ADC Quick Reference Guide

Programmable system monitors

- SPI
  - 10b — MAX1153/54
  - 12b — MAX1253/54
- I²C
  - 10b — MAX1361/62
  - 12b — MAX1363/64

High-resolution sigma-delta

- SPI
  - 16b — MAX1415/16
  - 18b
    - Mux In/Out — MAX1400/01
    - Current Sources — MAX1402/03
  - 24b
    - 4Ch — MAX11040*

Simultaneous sampling

- Serial
  - 10b
    - 2Ch — MAX1377*/79*/83*
  - 12b
    - 2Ch — MAX1378*/80*/84*
  - 24b
    - 4Ch — MAX11040*
- Parallel
  - 12b
    - 2Ch — MAX1306/10/14
    - 4Ch — MAX1305/09/13
    - 8Ch — MAX1304/08/12
  - 14b
    - 2Ch — MAX1318/22/26
    - 4Ch — MAX1317/21/25 MAX1338
    - 8Ch — MAX1316/20/24

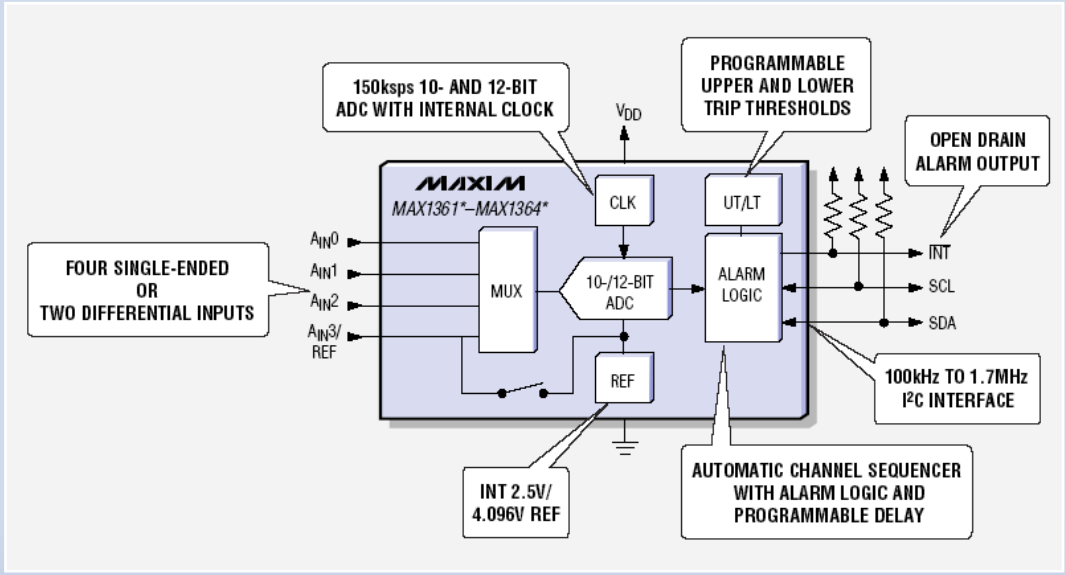
Panel meters

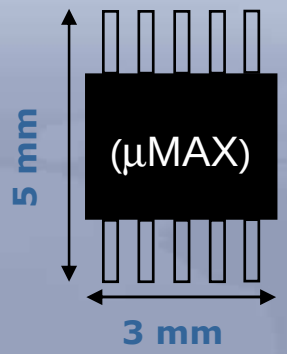
- LCD
  - 3.5 Digit
    - Stand Alone — MAX1491
    - Microcontroller — MAX1492
  - 4.5 Digit
    - Stand Alone — MAX1493/95
    - Microcontroller — MAX1494
- LED
  - 3.5 Digit
    - Stand Alone — MAX1496
    - Microcontroller — MAX1497
  - 4.5 Digit
    - Stand Alone — MAX1498/47
    - Microcontroller — MAX1499
  - 4–20mA
    - Stand Alone — MAX1365/67
    - Microcontroller — MAX1366/68

MAXIM

MAX1361-64 10-/12-Bit 150Ksps I2C Autonomous System Monitor

- Programmable High/Low Trip Thresholds
- Fault alarm interrupt output supporting SMBUS Alert Response
- Typical Applications
- Multi-card rack systems
- Servers
- Low power interrupt based designs

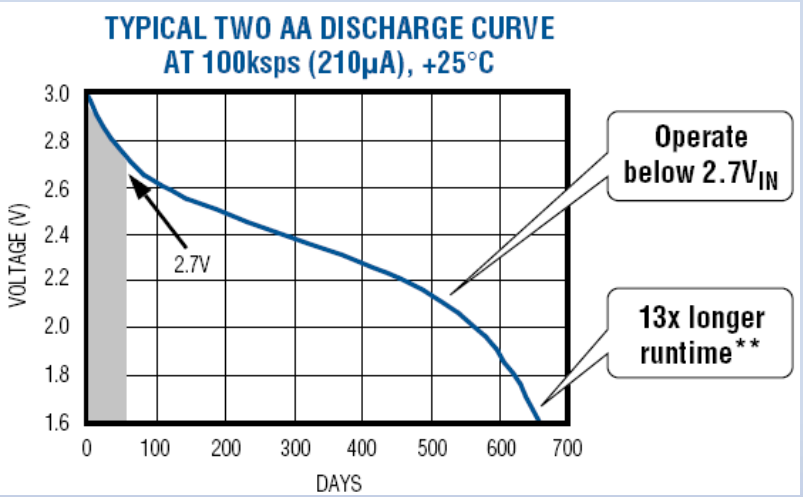


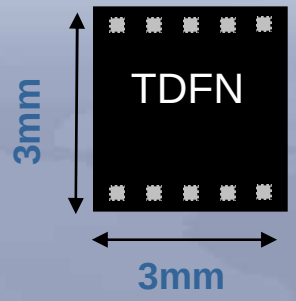


System Monitoring I2C ADCs		
	10 Bit	12 Bit
2.7-3.6V	MAX1361	MAX1363
4.75-5.25V	MAX1362	MAX1364

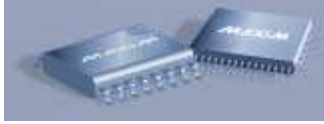
1.5 - 3.6V Ultra Low Voltage Family of 12/10/8-bit ADC in a TDFN

- Fast sampling rate up to 400Ksps
- 1.5V to 3.6V Supply
- Directly operate off battery down to 1.5V
- Typical Applications
- Portable Medical, Instrumentation
- Low power telemetry
- System monitoring

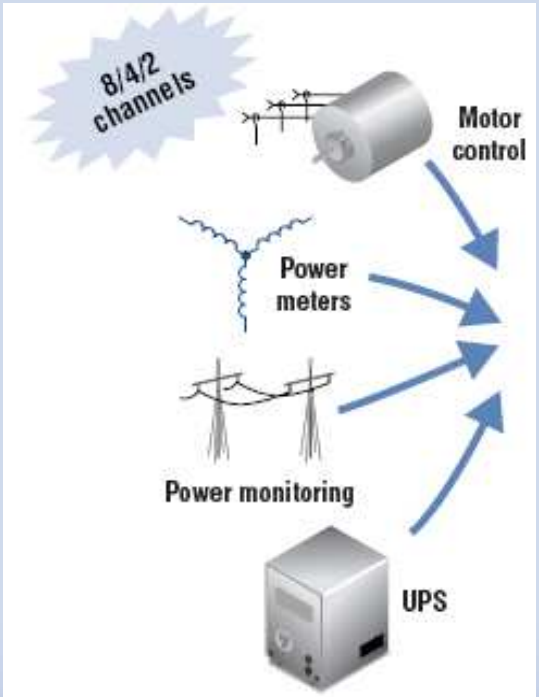


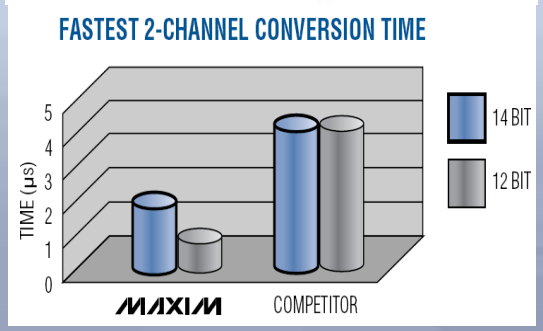


	8-Bits	10-Bits	12-Bits
Differential Input	MAX1391	MAX1392	MAX1393
Single-Ended Input	MAX1394	MAX1395	MAX1396



Simultaneous Sampling ADCs





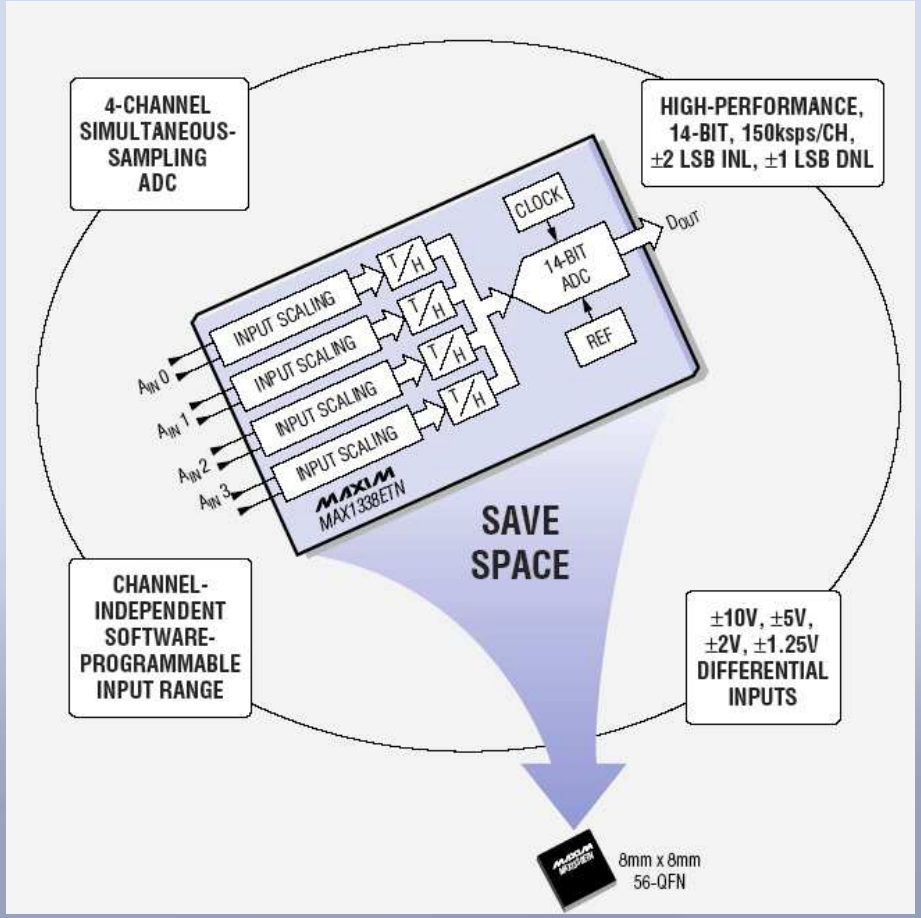
- Bipolar inputs with single supply
- Ideal for direct transformer, and sensor sampling
- Simultaneous sampling
- simplifies software, and reduces board components by preserving phase information.
- High Throughput (2 Msps max)
- Low latency

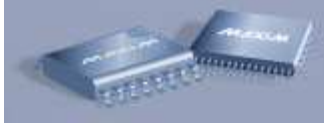
Resolution (Bits)	Input Range (V)	Number of Channels 8	4	2
12	0 to 5	MAX1304	MAX1305	MAX1306
	±5	MAX1308	MAX1309	MAX1310
	±10	MAX1312	MAX1313	MAX1314
14	0 to 5	MAX1316	MAX1317	MAX1318
	±5	MAX1320	MAX1321	MAX1322
	±10	MAX1324	MAX1325	MAX1326

14-Bit Simultaneous Sampling ADC with Software Programmable Input Range

MAX1338

- 4 Fully Differential Simultaneously Sampled Channels
- Channel Independent Software Programmable ±10, ±5, ±2.5, ±1.25V Input Range
- 150ksps/Channel
- Parallel Interface
- Typical Applications
- Instrumentation, Telemetry, Motor control, power grid monitoring

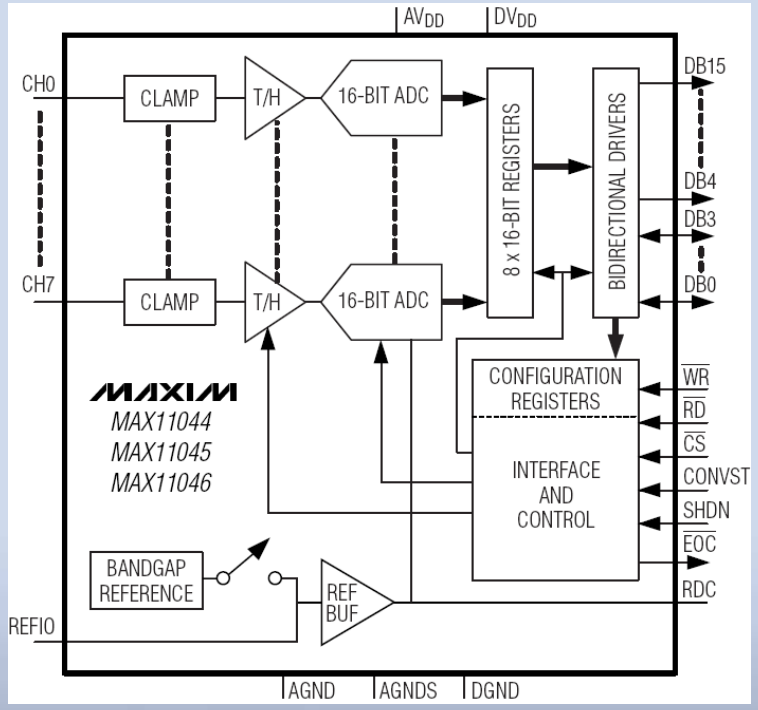


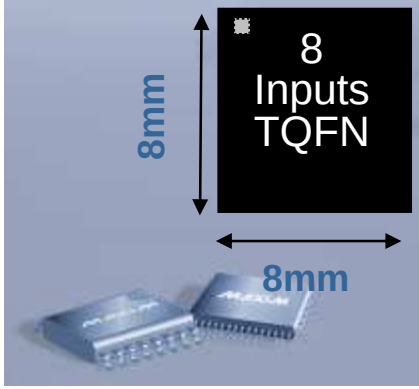


Smallest 8 Channel 16-Bit Simultaneous Sampling ADCs

FUTURE PRODUCT

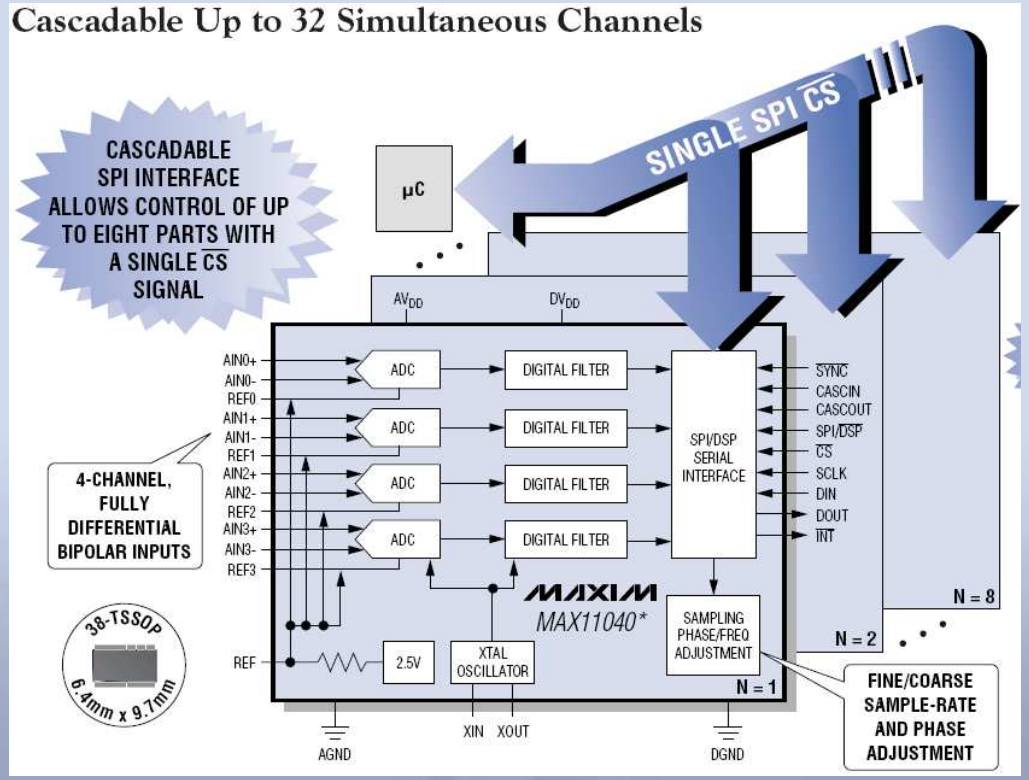
- Direct connection to +/-5V inputs
- Single +5V Supply
- Requires small number of capacitors
- Greatly reduces board layers, and simplifies layout.
- +/- 20mA input protection clamps
- clamps input voltage, protecting signal path.
- Easy to use 2Msps throughput parallel interface





Channels			Input Range (V)	Sample Rate/Ch (ksps)	SNR (dB)	SINAD (dB)
8	6	4				
MAX11049*	MAX11048*	MAX11047*	0 to 5	250	90	89.5
MAX11046	MAX11045*	MAX11044*	±5			

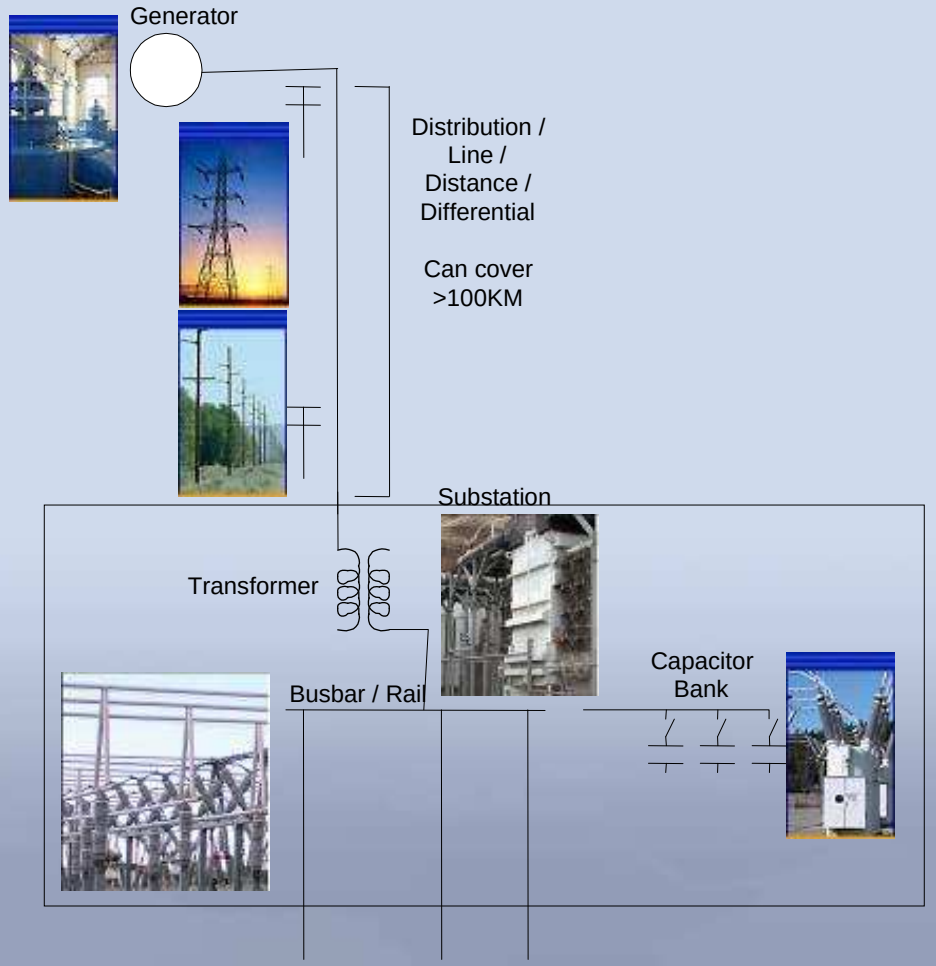
MAX11040 4-CH Simultaneous Sampling 24-Bit Sigma Delta ADC with Cascadable SPI Interface

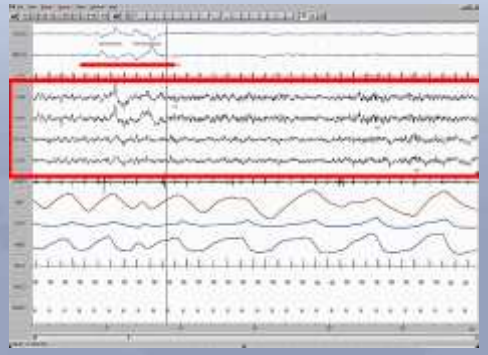


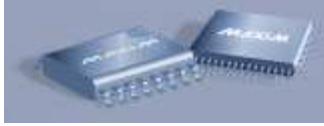
- ±2.2V Input Range with±6V overvoltage protection with a single 3V analog supply
- 0.06% fine data rate adjustment per channel and 1.33µs phase shifting for re-alignment of delays in each signal path.
- External SYNC input allows synchronization of sampling instance across multiple parts.
- Cascadable interface allows control of up to 8 MAX11040 with a single /CS signal
- 105dB SNR at 16 Ksps (117dB at 1ksps)
- -40 to +105℃

MAX11040 Application examples

- Powergrid
  - protection relays
  - powerquality modules
- Data aquisition
- Medical
  - EKG
  - Polysomnography

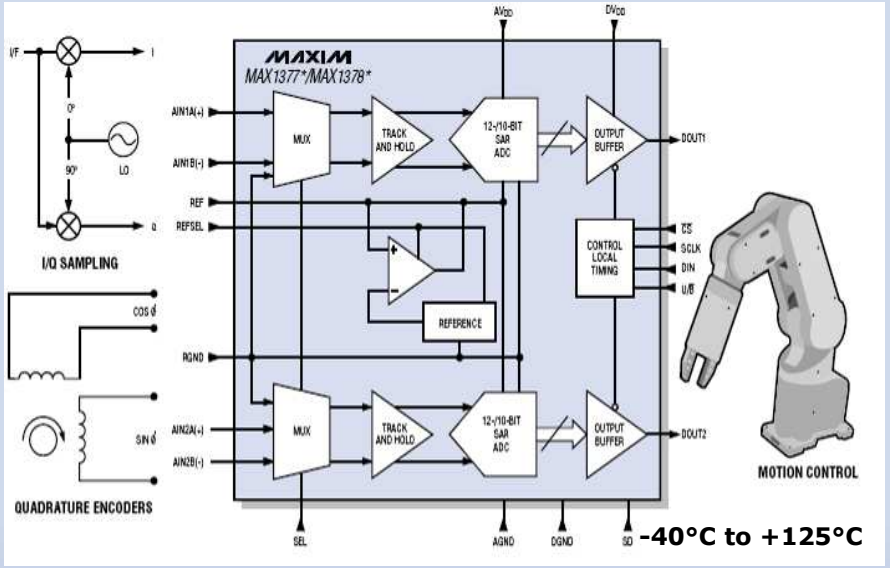


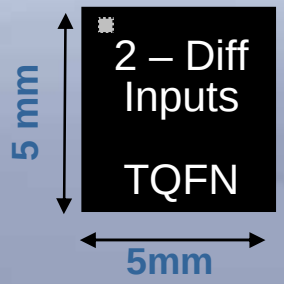




12-bit, Dual 1.25Msps Serial Output Simultaneously Sampling ADC

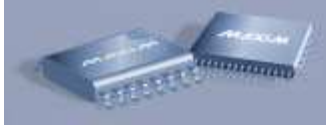
- Concurrent serial outputs eliminates reduces conversion latency
- +/-10V fully differential or single ended input range using single +5V Supply
- Typical Applications
- Motor Control
- Communication Systems
- IQ Encoding, Radar





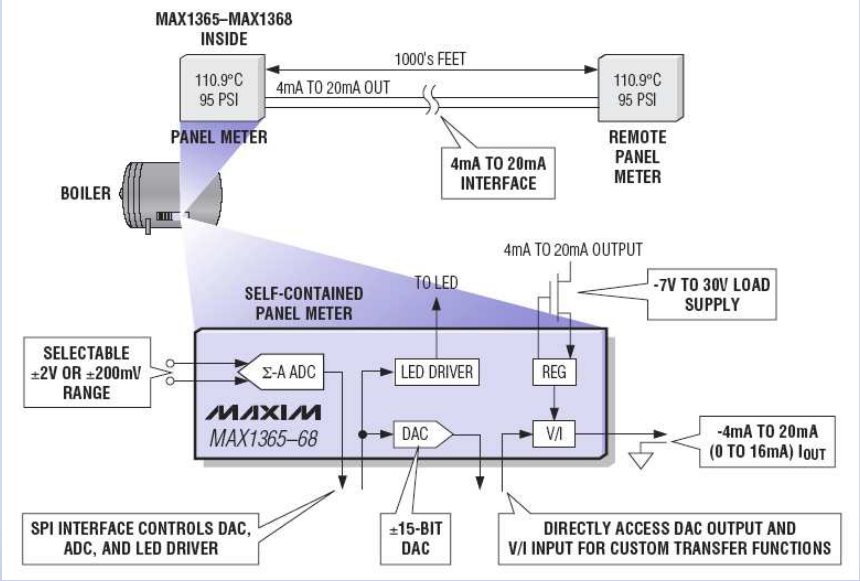
Part	Simultaneous Channels	Speed (ksps)	Conversion Time (µs)	Supply Voltage (V)	Input Range (V)	Reference (V)
MAX1377 MAX1379 MAX1383*	2x2	2 x 1,250	0.8	3	Vref, +/- Vref/2	I/2.048
				5		I/4.096
					+/-10	I/2.5

* Future Product



World's Smallest Integrated Panel Meter Solutions with Industrial 4-20mA Output

- 4mA to 20mA Output Easily Drives Remote Displays
- 15-Bit Resolution DAC
- 14-Bit Linear V/I Converter
- Unipolar or Bipolar Mode



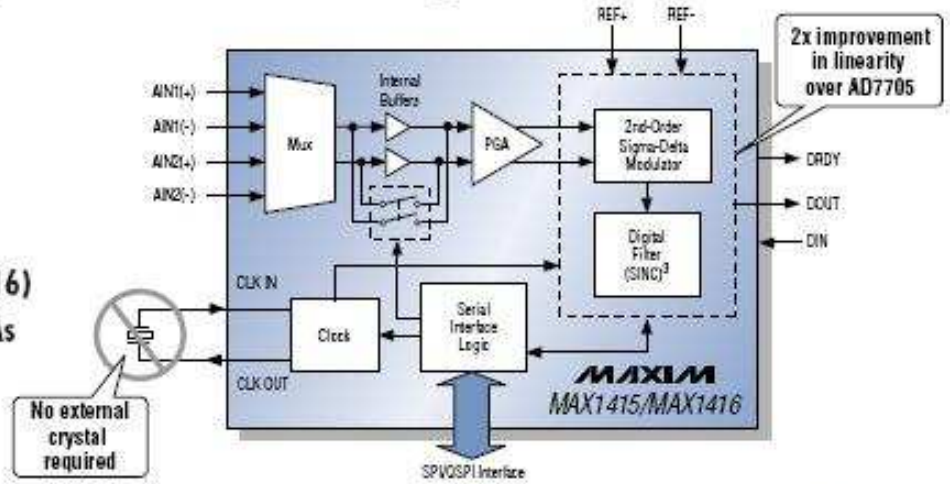
4-20mA Output Panel Meter ADC

Digits	LED	Resolution (Counts)	Input Range	Interface	Pin-Package
3 1/2	MAX1367	± 1999	± 200 mV ± 2 V	Stand-Alone	48-TQFP
	MAX1368			Serial	
4 1/2	MAX1365	± 19999		Stand-Alone	
	MAX1366			Serial	

MX7705 16 Bit Sigma Delta

Pin-compatible upgrades to AD7705 have improved accuracy, internal clock

- 2-channel, 16-bit sigma-delta ADC
- 0.0015% FSR INL, no missing codes
- Internal oscillator (MAX1415/MAX1416)
- 1 to 128 on-chip PGAs



Part	Resolution (bits)	No. of channels	Clock	Excitation current (µA)	Supply voltage (V)	Package
MAX1400	18	5	Ext crystal	—	5	28-SSOP
MAX1401					3	
MAX1402				2 x 200 matched	5	
MAX1403					3	
MX7705	16	2	Ext crystal	—	3/5	16-TSSOP
MAX1415/MAX1416			Int oscillator			

MAXIM

ADC Future

Introduced

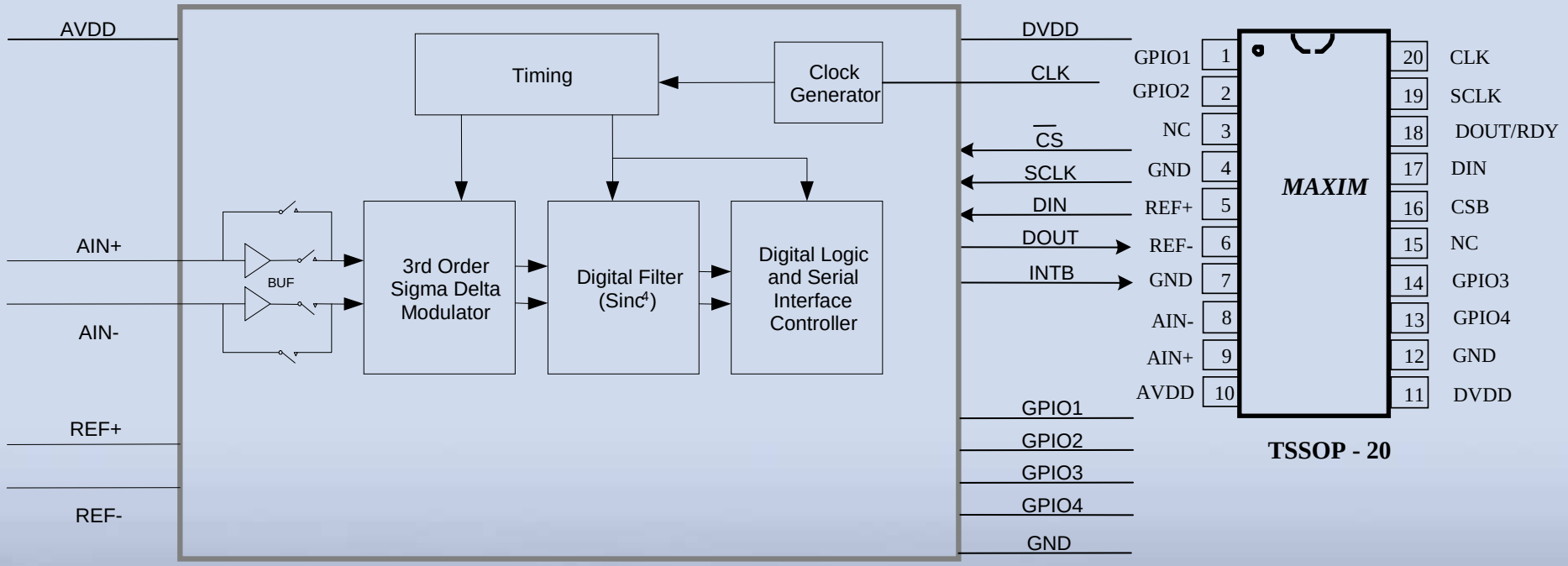
In Design

2008	2009	2010
MAX11040 *24-Bit 4-Ch 64ksps* •Fully Differential Simultaneous •SPI Cascading Interface • +/- 6V input protection	*8, 10,12-bit 8-Ch I2C* — MAX 116xx • Add 8-ch to 8, 10 & 12 bit	
MAX1377/79/83 *12-bit 2x1.25Msps* •Concurrent Serial interface •Fully Differential & Simultaneous • +/- 10V input range	*MAX1300/2,1032/4,* *I2C* •Updated Process •	
MAX11045 - 49 *16-Bit 4,6,8-Ch 250ksps* • Simultaneous sampling • Parallel interface • ±5V	*1,3 MSPS 12-Bit 1,2-Ch Low cost TDFN/SOT23* — MAX 111xx • Lowest Pwr: 11mW 3MSPS, 5.5mW 1MSPS • Platform core	
	16-bit 1-ch SD SPI *16-bit NFR 120SPS – low cost*	
	24-bit 1-ch SD SPI *22-bit NFR 10SPS* — MAX 11200 • Market leading NFR • 4 GPIO • AVdd = 3V, DVdd = 1.8V to 3.3V	
	12-bit 8,12,16-ch SPI — AC19 • Repackage 8, 12, 16-ch offering	

Intro year

MAXIM

MAX11200 24 Bit Delta sigma Ultra Low Power with SPI Interface



Key applications

- **Sensor measurement (such as temperature and pressure)**
- **Portable instrumentation**
- **Battery-powered applications (hand held gas monitoring)**
- **Weigh scales**
- **2 wire sensors**

MAX11200 24 Bit Delta sigma
Ultra Low Power with SPI Interface

- **22 bits noise free range @ 10SPS, 3.3V FS**
  - **Allows customers to simplify external (OpAmp) signal conditioning**
- **300uA operating current @ 10SPS**
  - **Safe operating margin for the current consumption budget allowed for devices powered by the 4-20 mA network**
- **4 SPI-controlled digital outputs for external MUX control**
  - **Low control pin count convenient when ADC is near probe tip or connected to uC via Flex cable**

- **Fully differential analog inputs**
- **3V analog supply; 3V or 1.8V digital interface supply**
- **Fully differential voltage reference inputs**
- **Optional input buffering**
- **Internal 2 MHz clock generator or external clock interfa**
- **SPI compatible serial interface**
- **Self-calibrating routine for offset and gain, can be user-ini**
- **User programmable offset and gain registers**
- **24bit full scale resolution**
- **Power down and sleep modes**

First samples End Q2 CY09

MAXIM

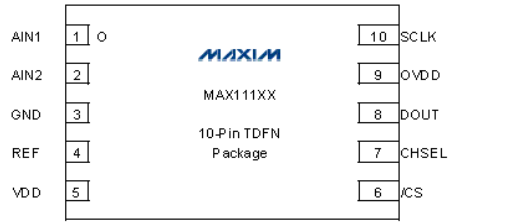
MAX111xx New 1 & 3MSPS 12-/10-/8- SPI ADC

Part	Package	Temp	Bits	Speed
MAX11101	10-Pin TDFN	-40 to 125C	12	3 MSPS
MAX11102	10-Pin TDFN	-40 to 125C	12	1 MSPS
MAX11103	10-Pin uMax	-40 to 125C	12	3 MSPS
MAX11104	10-Pin uMax	-40 to 125C	12	1 MSPS
MAX11105	6-Pin SOT23	-40 to 125C	12	1 MSPS
MAX11106	10-Pin TDFN	-40 to 125C	10	3 MSPS
MAX11107	10-Pin TDFN	-40 to 125C	10	1 MSPS
MAX11108	10-Pin uMax	-40 to 125C	10	3 MSPS
MAX11109	10-Pin uMax	-40 to 125C	10	1 MSPS
MAX11110	6-Pin SOT23	-40 to 125C	10	1 MSPS
MAX11111	10-Pin TDFN	-40 to 125C	8	3 MSPS
MAX11112	10-Pin TDFN	-40 to 125C	8	1 MSPS
MAX11113	10-Pin uMax	-40 to 125C	8	3 MSPS
MAX11114	10-Pin uMax	-40 to 125C	8	1 MSPS
MAX11115	6-Pin SOT23	-40 to 125C	8	1 MSPS

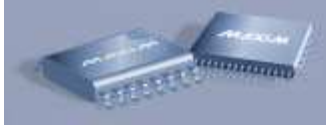
Key Features:

- 12/10/8-Bit Resolution
- 1/3 MSPS Conversion Rate
- 2.2V to 3.6V Supply Voltage
- 11 mW at 3 MSPS @ Vdd=3V
- 5.5 mW at 1 MSPS @ Vdd=3V
- 2 Muxed Single Ended Analog Input Pins (TDFN/uMax only)
- External Reference Input Pin
- 70dB SINAD at 1MHZ Input
- 0.5uA max Power Down Mode
- 10-Pin 3x3/5mm TDFN/uMax Package
- 6-Pin 3x3mm SOT23 Package
- Partial and Full Power Down Modes

Pin Configurations:



Note: uMax package has leads, but pin arrangement is identical to TDFN package



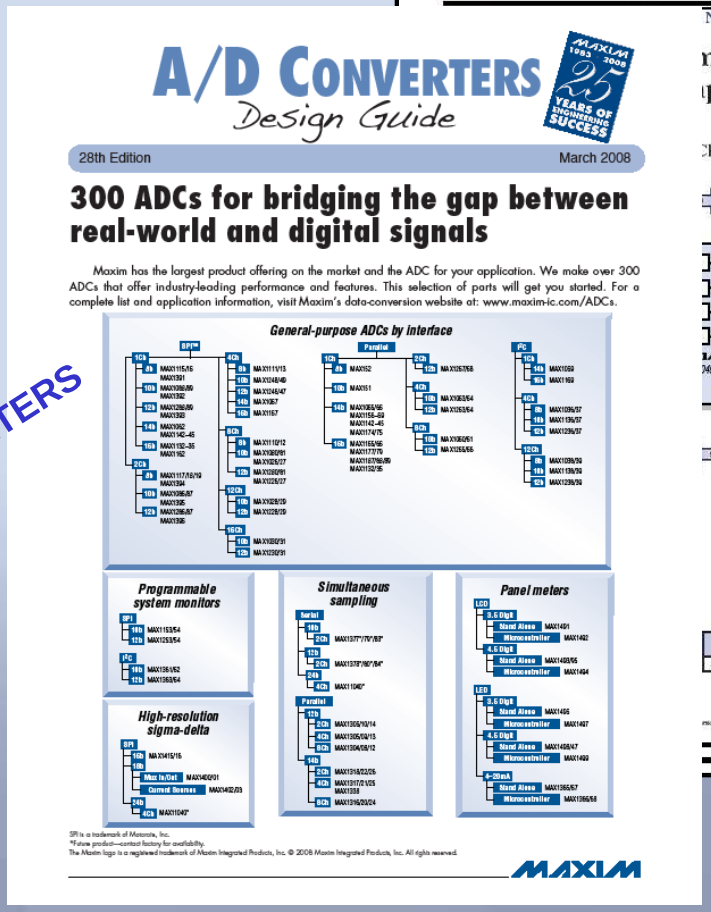
Information material

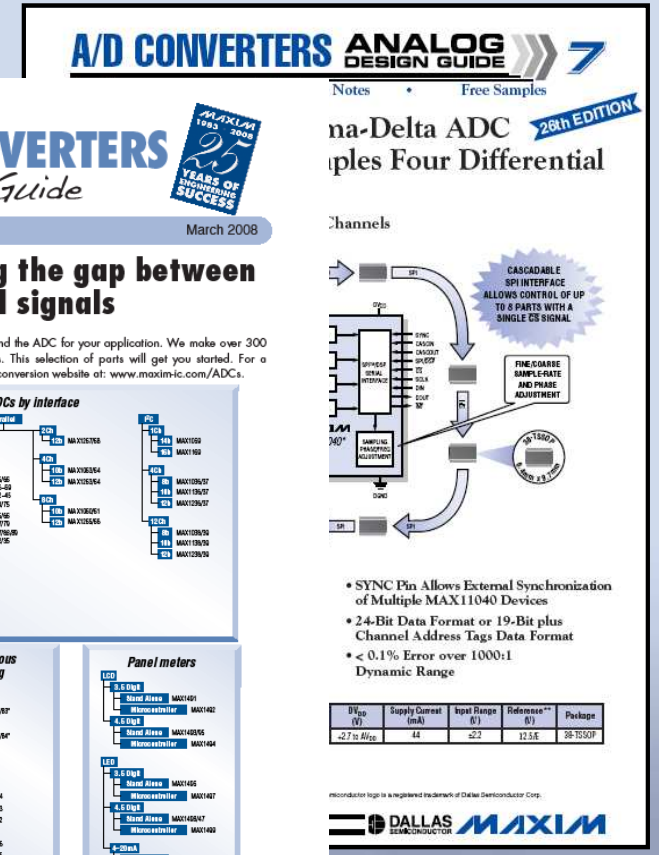
Look for the latest

ADC DESIGN GUIDE

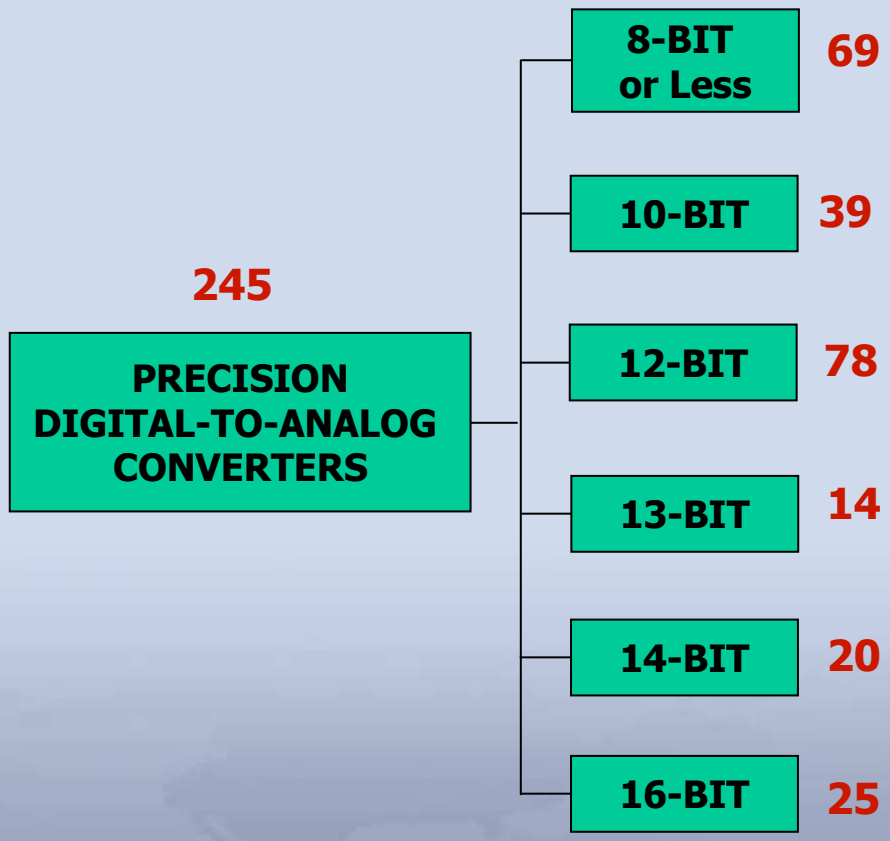
This is your guide to Maxim Precision ADCs!

http://www.maxim-ic.com/cgi-bin/dg?dg=AD_CONVERTERS



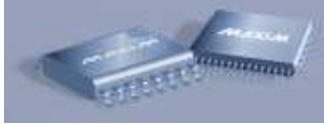


CORE PRODUCTS
LARGEST SELECTION OF PRECISION DACs



- Large Selection of Multichannel DACs
- 245 root part numbers with 2500 variations
- Single, Dual, Triple, Quad, Octal, 16-channel, 32-channel
- Resolutions from 6-bits up to 16-bits
- Parallel and High Speed Serial (SPI, I2C) Interfaces
- Fast Settling Voltage Output DACs: ≤1µs
- Small Size (SOT23, QFN, µMAX) & High Accuracy: ≤1LSB INL

WE PROBABLY HAVE A DAC FOR EVERY POSSIBLE APPLICATION YOU COME ACROSS



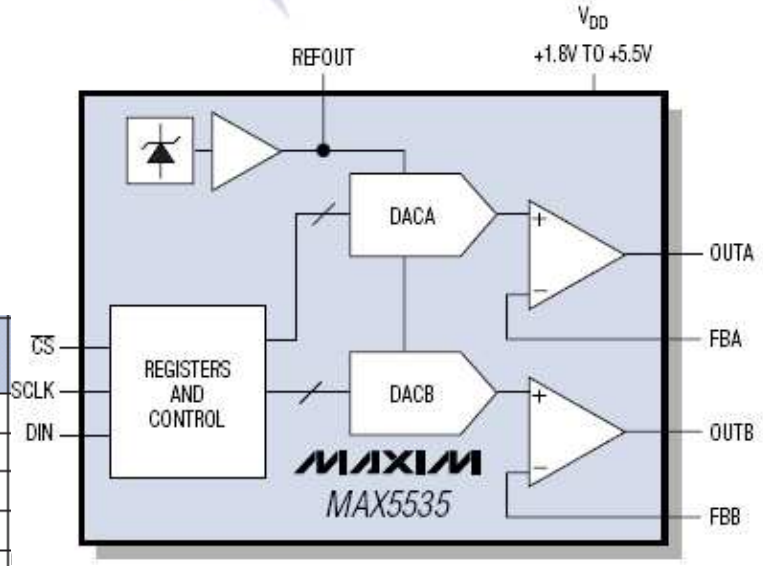
MAXIM

Ultra Low Power
MAX55xx with 5uA(max) supply current

- Ultra-Low 5µA (max) Supply Current
- Internal or External Voltage Reference
- Wide, +1.8V to +5.5V Single-Supply Range
- Flexible Force-Sense (F/S) or Unity-Gain (x1) Output Configurations
- Single or Dual Channels
- 8-, 10-, 12-Bit Resolutions Guaranteed Monotonic
- Fast 16MHz, SPI-Compatible Serial Interface
- Tiny, 4mm x 4mm TQFN or 5mm x 3mm µMAX® Package

Reference Output Sources as Much as 8mA

Input Consumes Less than 5µA (max)/DAC Supply Current



Part	Resolution (Bits)	No. of Channels	Reference	Output Configuration	Package
MAX5510/11	8	1	Int, ext	F/S	12-TQFN
MAX5512–15	8	2	Int, ext	F/S, x1	12-TQFN, 8-µMAX
MAX5520/21	10	1	Int, ext	F/S	12-TQFN
MAX5522–25	10	2	Int, ext	F/S, x1	12-TQFN, 8-µMAX
MAX5530/31	12	1	Int, ext	F/S	12-TQFN
MAX5532–35	12	2	Int, ext	F/S, x1	12-TQFN, 8-µMAX

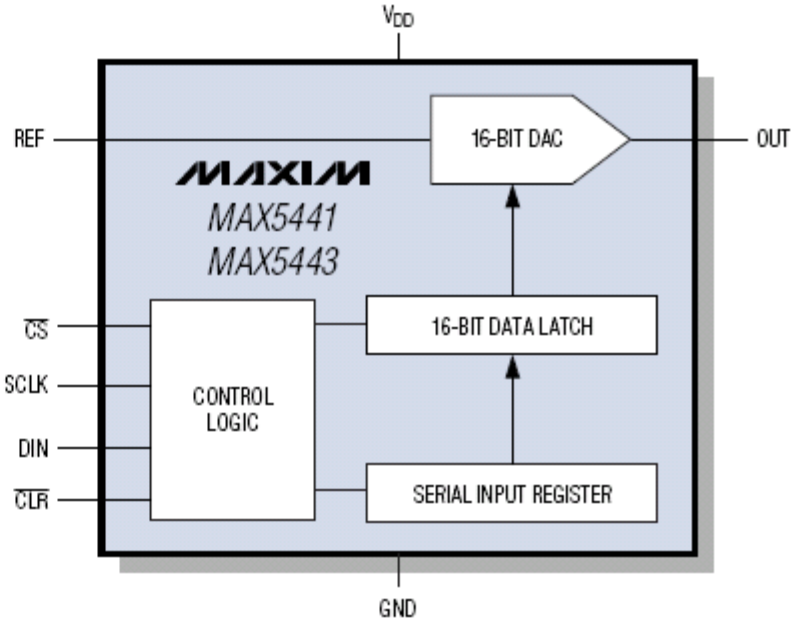
Accuracy with Low Power
MAX544x with 120uA supply current and 16Bit

Low Power
- 120µA Supply Current

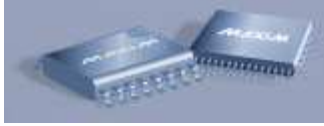
Accurate
- Guaranteed Monotonic to 16 Bits
- 2 LSB (max) INL

Small Size—8-Pin µMAX Package
- 15mm² Footprint

Additional Features
- Fast 1µs Settling Time
- 25MHz SPI-/QSPI-/MICROWIRE-Compatible Interface



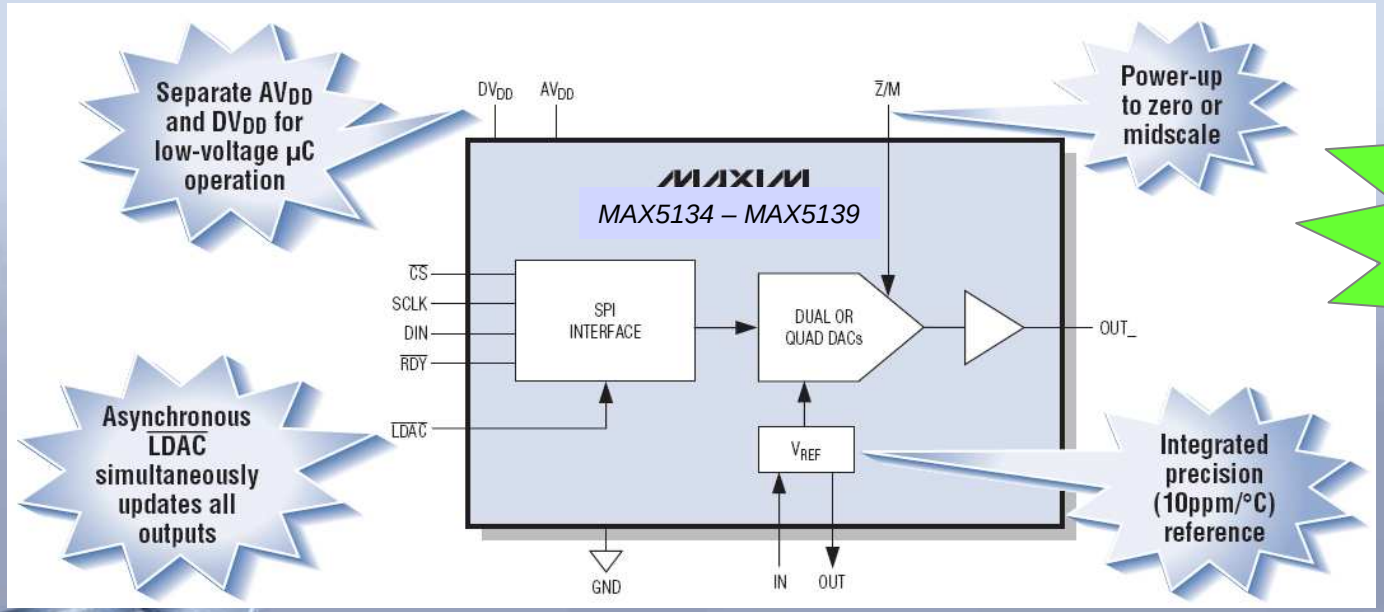
Part	Resolution (Bits)	Supply Voltage (V)	Output Swing	Package
MAX5441	16	+4.5 to + 5.5	Unipolar	8-µMAX
MAX5442	16	+4.5 to + 5.5	Bipolar	10-µMAX
MAX5443	16	+2.7 to + 3.6	Unipolar	8-µMAX
MAX5444	16	+2.7 to + 3.6	Bipolar	10-µMAX



New 16 bit DAC family for the industrial market
MAX513x 12-/16-BIT

- 1/2/4 channel parts are Software Compatible
- 2 and 4 channel parts are Pin Compatible
- All parts software compatible
- 4X4mm 24-pin or 3*3 mm 16-pin
- Daisy Chainable
- -40℃ to +105℃

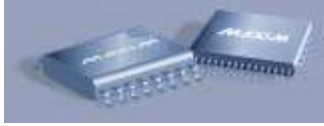
Part	Resolution (Bits)	No. of DACs	Supply Voltage (V)
MAX5134*	16	4	+2.7 to +5.25
MAX5135*	12	4	
MAX5136*	16	2	
MAX5137*	12	2	
MAX5138*	16	1	
MAX5139*	12	1	



Samples and EV kits available

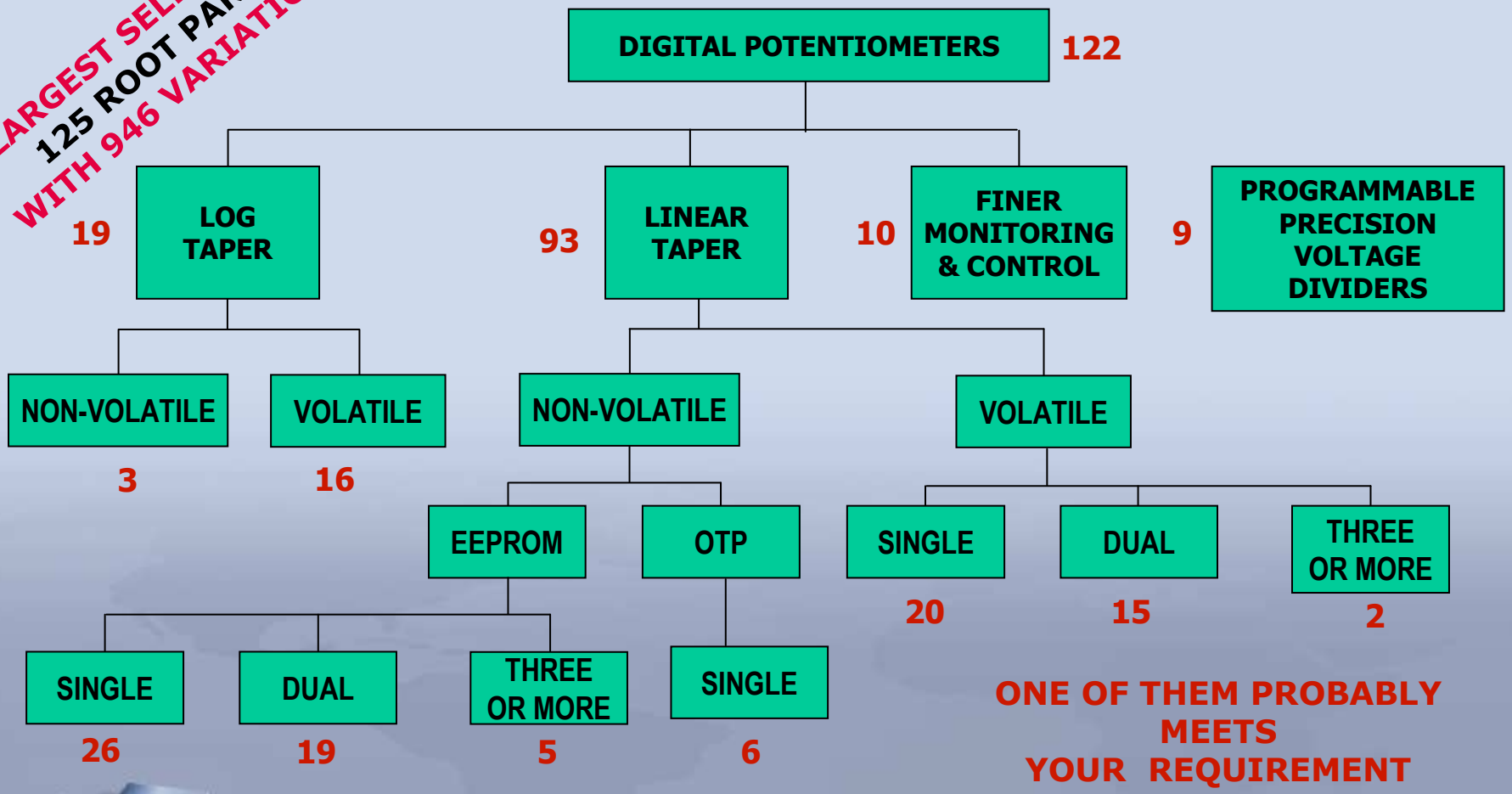
Where are they used

- Industrial Process Controls
- Automated Test Equipment (ATE)
- Programmable Logic controller
- System Process Monitors
- CCTV Security
- Medical - Ultrasound, X-Ray, MRI, CAT CT Scanners, Patient Monitors, Blood Analysis . . .
- Optical Fiber Amplifiers, Bias, Gain, Offset
- Test and Measurement, Calibration
- AND MANY MORE



DIGITAL POTENTIOMETERS

LARGEST SELECTION
125 ROOT PARTS
WITH 946 VARIATIONS



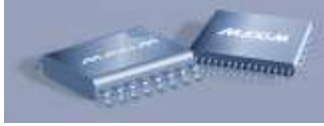
ONE OF THEM PROBABLY MEETS YOUR REQUIREMENT

MAXIM

MAX5436-MAX5439
128 Tap High Voltage Pots

Audio Compatible Glitchless Switching Between the Resistor Taps

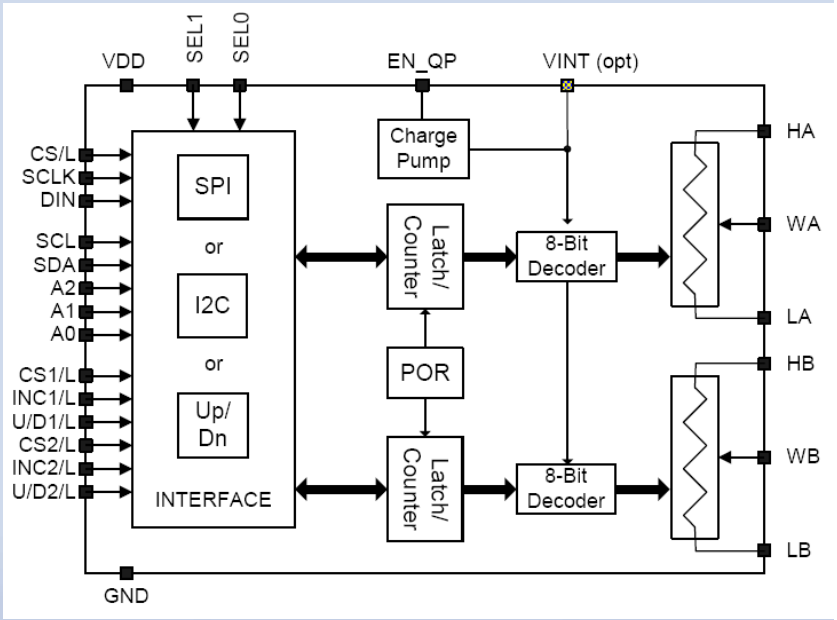
Applications Notes 803, 864



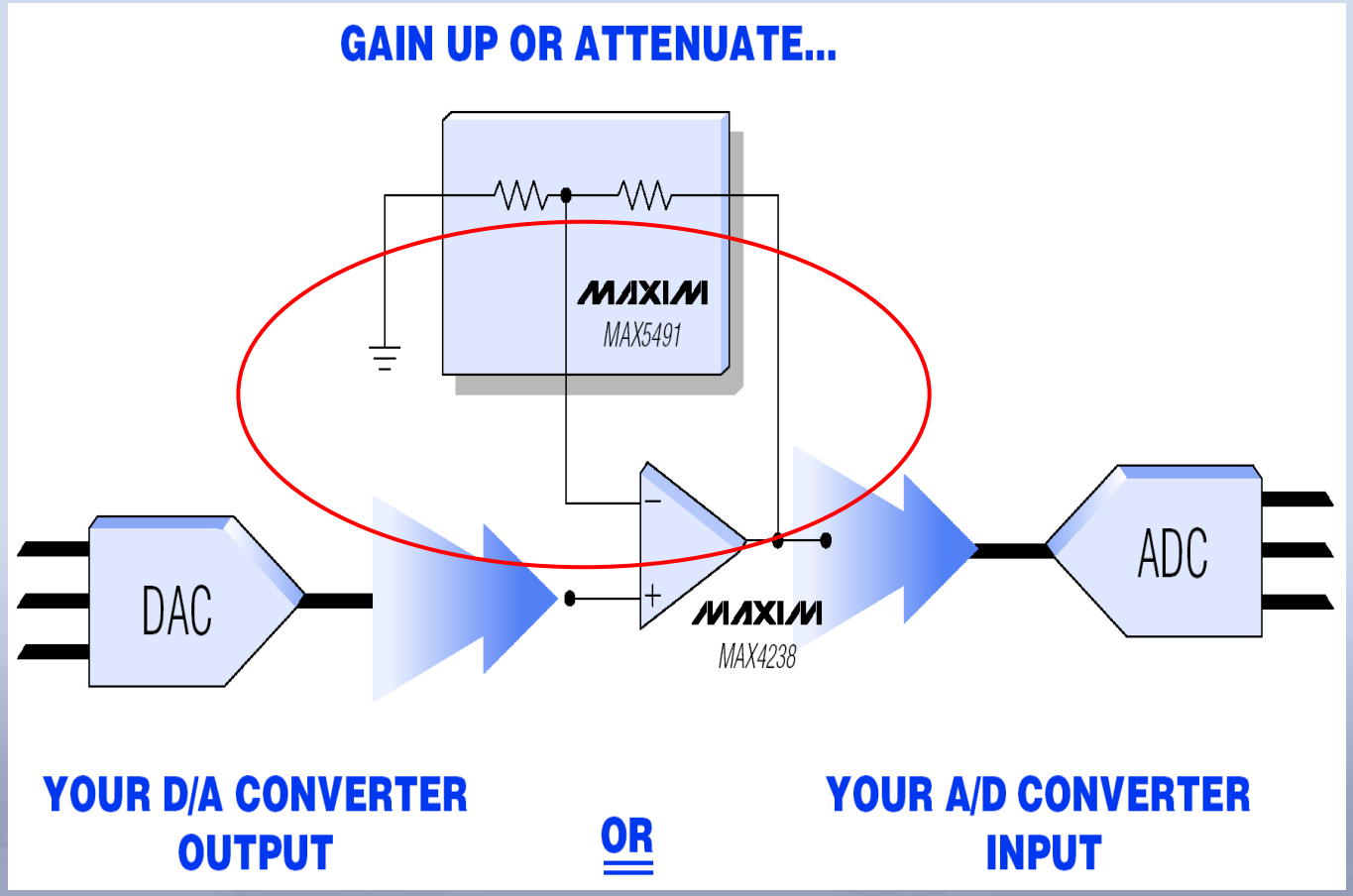
MAXIM

New Digipots

- NEW Familiy with 3 resistances: 10k, 50k, 100k
  - 3 interfaces: I2C, SPI, Parallel
  - 3 packages: 10-uMAX, 14-TSSOP, 16-TQFN
  - with or without charge pump
  - 1.8V to 5.5V single supply operation.
  - Temp range -40 to 125℃
- Potentially 54 new products although not all will be released due to market requirements
- Some products will be pin-compatible with existing parts giving a cost down.
- Status – Available 2H 2009



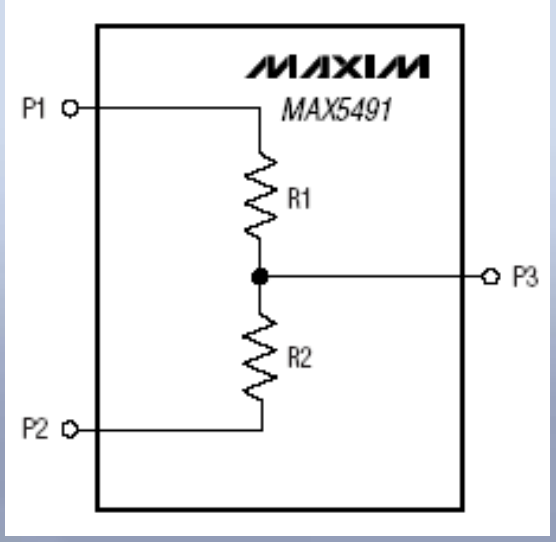
MAX5491 Resistor Dividers – the Zero Transistor IC



Precision Resistor Dividers

- 2ppm/℃ Temp Drift over -40℃ to +125℃
- Ratios Accurate to 0.035% (max)
- 3-pin SOT23 Package
- Up to 80V Continuous Working Voltage
- 10kΩ, 30kΩ, and 100kΩ End-to-End Resistances
- 10 Standard Ratios for Each Resistance Available For Ordering At Any Time
- Custom Trimmed Ratios Upon Request

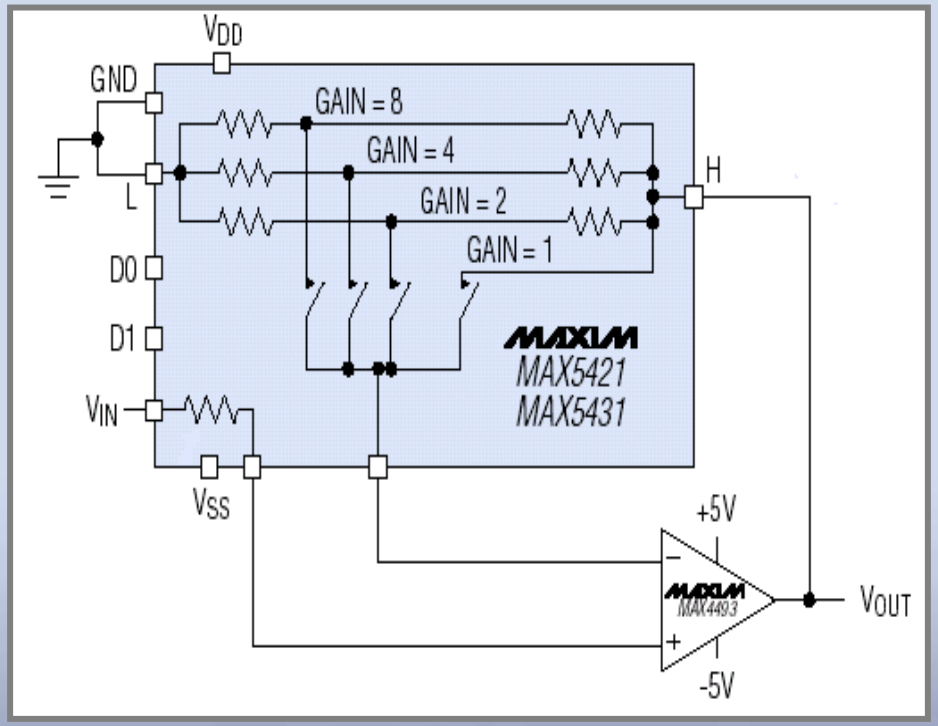
MAX5490-MAX5492:
Accuracy 0.035%
Drift < 2ppm/°C

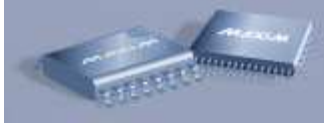


Precision Voltage Dividers for PGAs

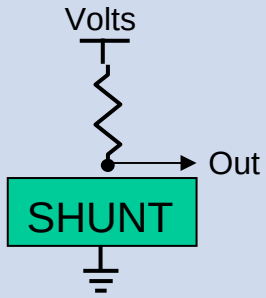
MAX5420/1, MAX5430/1

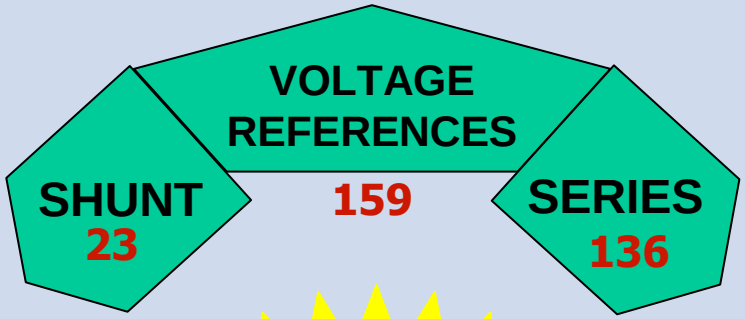
- Provides 4 Precision Ratios for Noninverting Gains of 1, 2, 4, and 8
- Resistors Accurate to 0.025%, 0.09%, and 0.5% Over -40℃ to +85℃
- Temperature Drift Less Than 1ppm/℃
- On-Chip Matching Resistor Compensates for Offsets Caused by Input Bias Current (MAX5421/MAX5431)
- Single +2.7V to +5.5V (MAX5420/1), Dual +/-5V (MAX5420/1), Dual +/-12V to +/-15V (MAX5430/1) Supplies
- Small µMAX Package

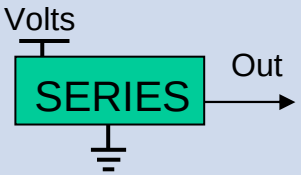




VOLTAGE REFERENCES







Lowest Noise

MAX6126

- 3ppm/°C (max)
- 0.02% Initial Accuracy (max)
- 1.3µV$_{P-P}$ Noise
- 550µA (max) Supply Current
- µMAX Package

Lowest Power

MAX6133

- 3ppm/°C (max)
- 0.04% Initial Accuracy (max)
- 16µV$_{P-P}$ Noise
- 60µA (max) Supply Current
- µMAX Package

Lowest Tempco

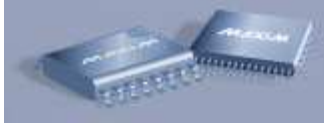
MAX6325 Family

- 1ppm/°C (max)
- 0.02% Initial Accuracy (max)
- 1.5µV$_{P-P}$ Noise
- 3mA (max) Supply Current
- SO Package

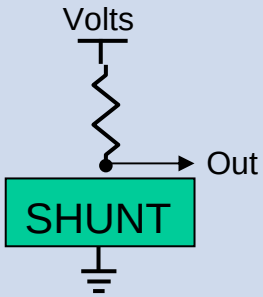
-159 root parts with 2245 variations

MAXIM

VOLTAGE REFERENCES MARKET LEADER
with largest portfolio on the market



2 Pin/ Shunt References

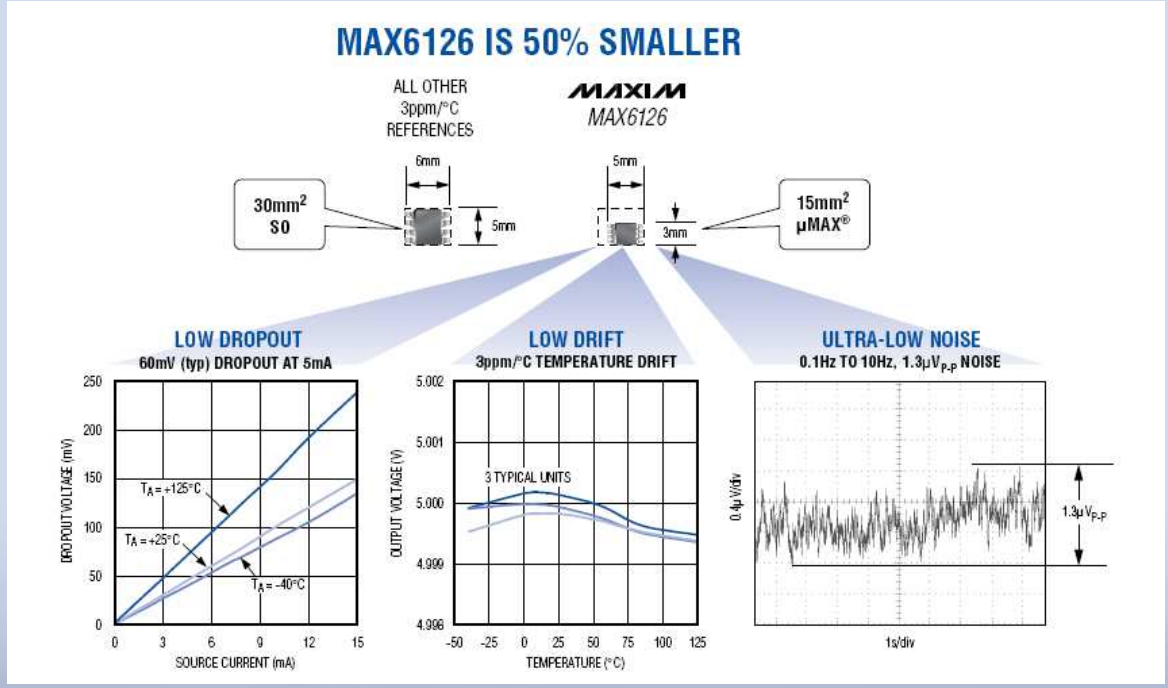


LM4040
LM4041
LM4050

Specialities :

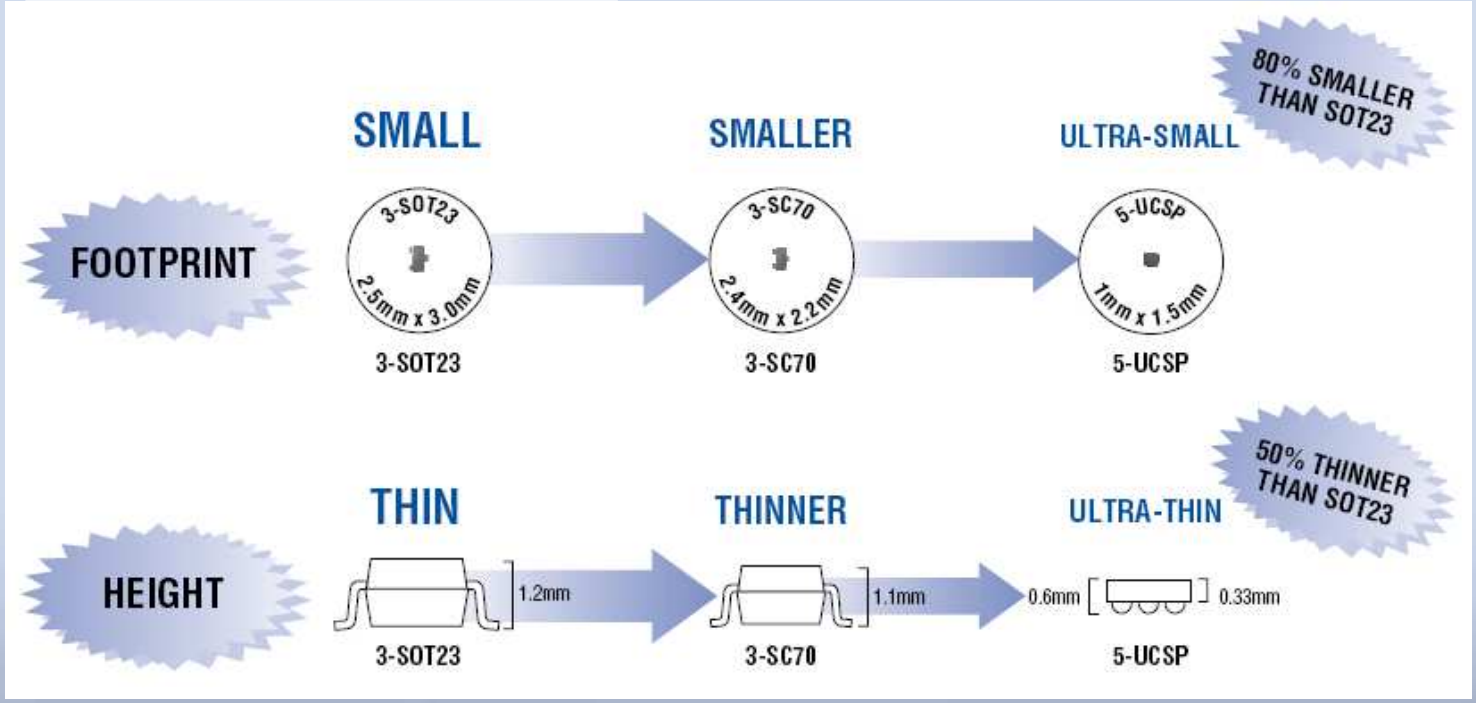
Part	Output voltage (V)	Initial accuracy (%)	Tempco (ppm/°C)	Minimum reverse current (µA)	Features
MAX6138	1.25, 2.048, 2.5, 3.0, 4.096, 5.0	±0.1	25	65	Ultra-small, 2mm x 2mm SC70 package
MAX6006–MAX6009	1.25, 2.048, 2.5, 3.0	±0.2	30	1	Low operating current

Industrial standards
MAX6126 3ppm (-40℃ to +85℃) in 15mm2
MAX6033 7ppm (-40℃ to +85℃) in 9mm2

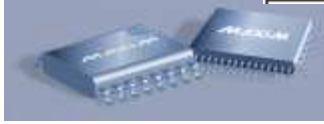


Part	Output Voltage (V)	Grade	Guaranteed Tempco (ppm/°C, max)		Initial Accuracy (%, max)	Supply Voltage Range (V)	Supply Current (µA, typ)	Source Current (mA)	Dropout Voltage (mV)	Price† ($)
			-40°C to +85°C	-40°C to +125°C						
MAX6033	2.500, 3.000, 4.096, 5.000	A	7	10	±0.04	2.7 to 12.6	40	15	200	3.49
		B	10	15	±0.08					2.40
		C	20	40	±0.10					1.45

Ultra small
MAX6023 30ppm (-40℃ to +85℃) in 1.5mm2

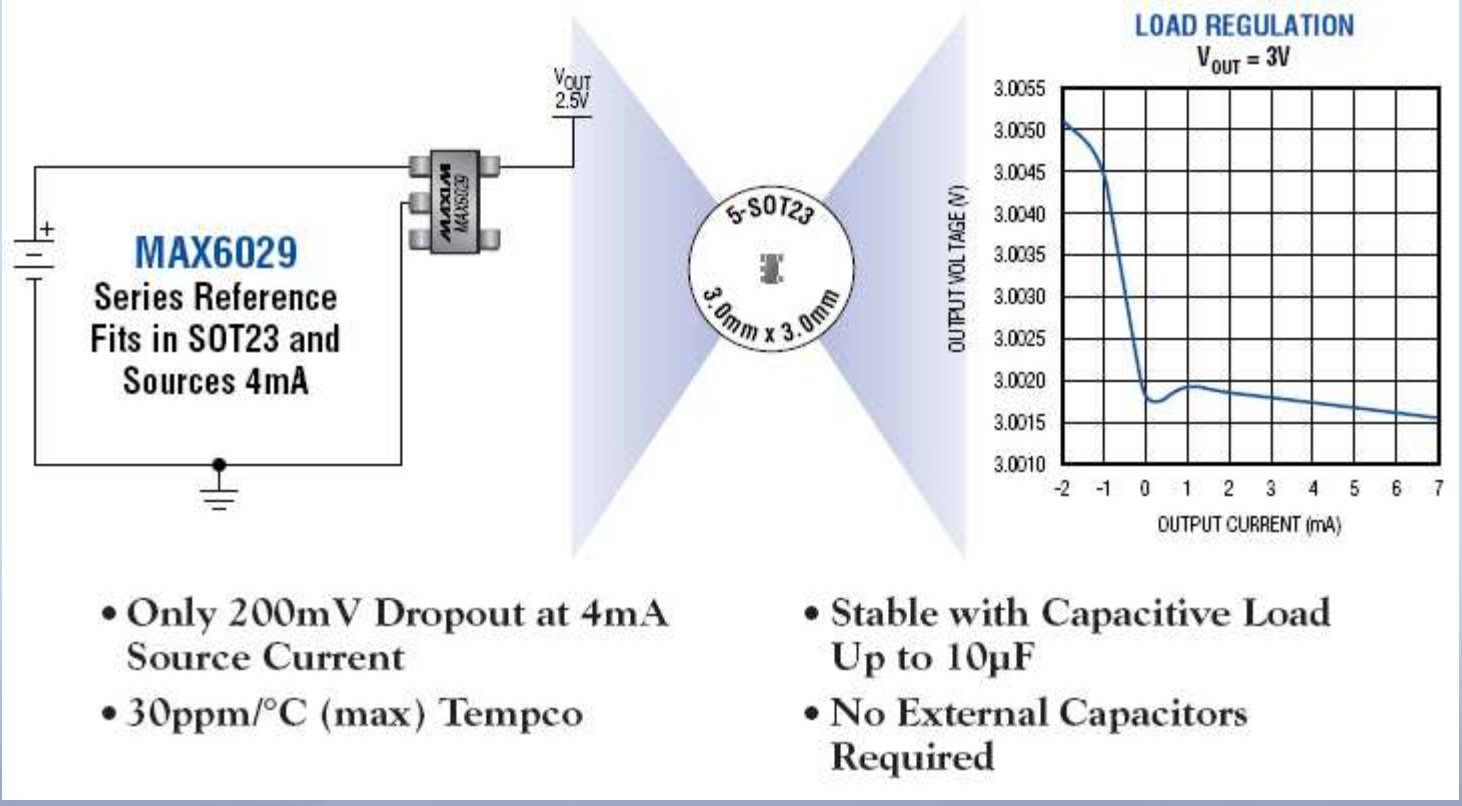


Part	Output Voltage (V)	Input Voltage (V)	Dropout Voltage (mV)	Temperature Coefficient (ppm/°C, max)	Initial Accuracy (%, max)
MAX6023	1.25, 2.048, 2.5, 3.0, 4.096, 4.5, 5.0	2.5 to 12.6	200	30	±0.20



MAXIM

Ultra low power
MAX6029 5.25uA(max) supply current

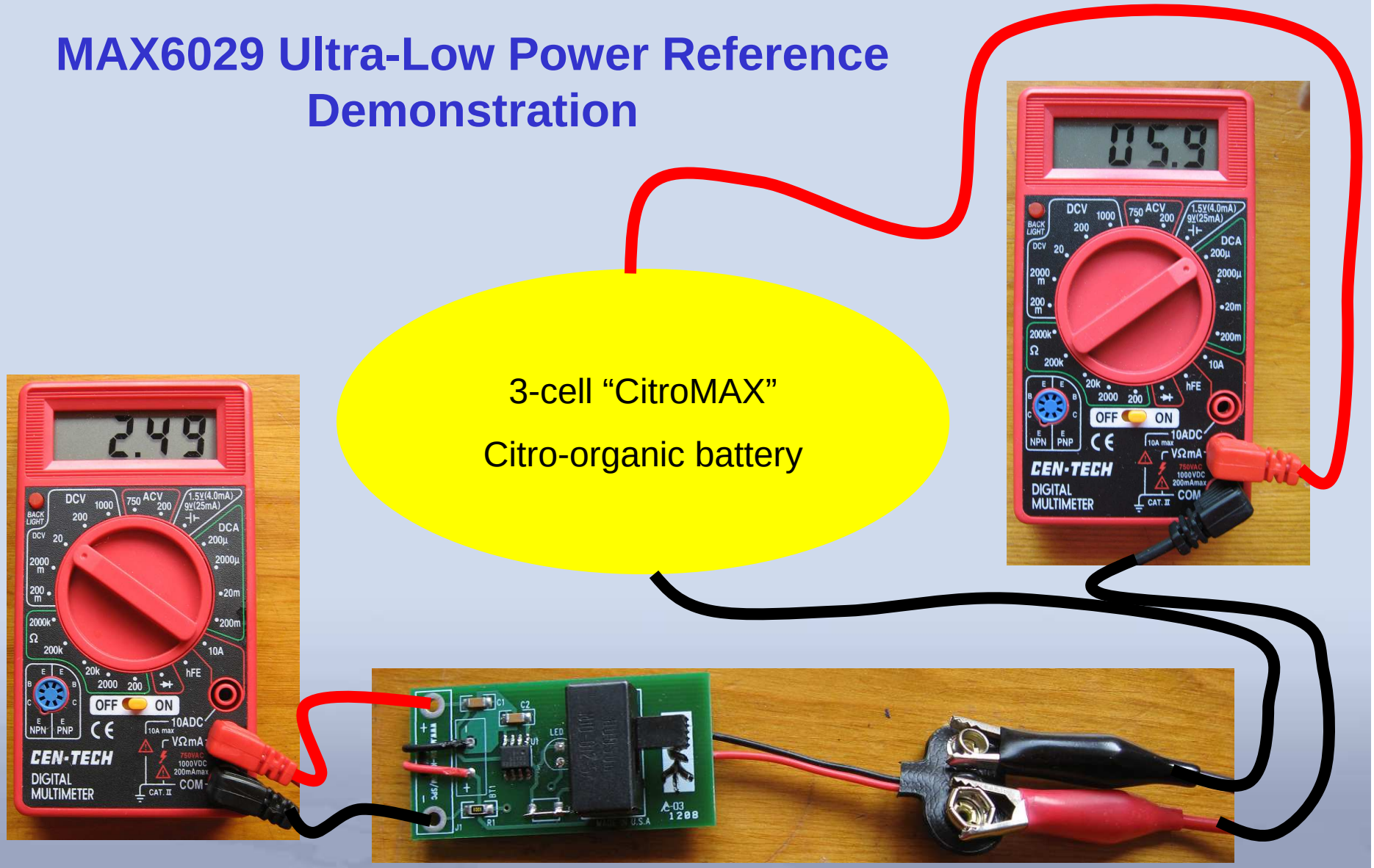


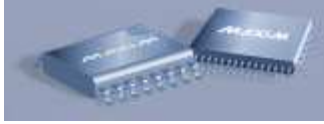
- Only 200mV Dropout at 4mA Source Current
- 30ppm/°C (max) Tempco
- Stable with Capacitive Load Up to 10µF
- No External Capacitors Required

Part	Output Voltage (V)	Temperature Coefficient (ppm/°C, max)	Initial Accuracy (%, max)
MAX6029	2.048, 2.5, 3.0, 3.3, 4.096, 5.0	30	±0.15

MAXIM

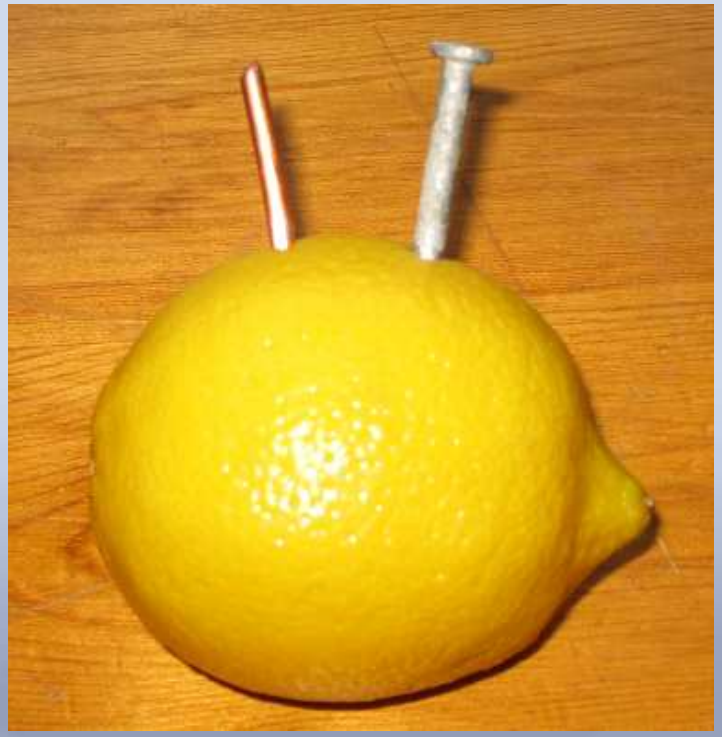
MAX6029 Ultra-Low Power Reference Demonstration





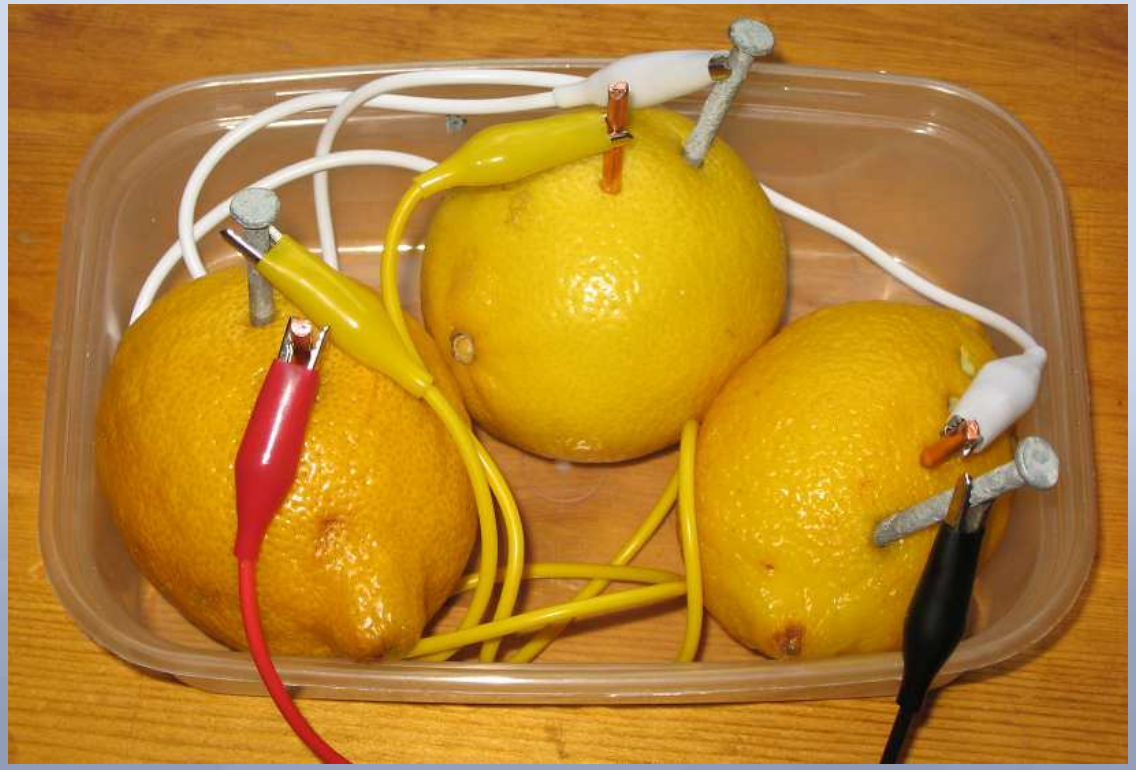
“CitroMAX”, The “Citro-Organic” Battery

- Just to make the point how little current some references really take.
- The “CitroMAX” cell
- Potential Difference of Metals
  - Copper = +0.345V
  - Zinc = -0.758V
  - Total = 1.103
  - Practically we get around 900mV

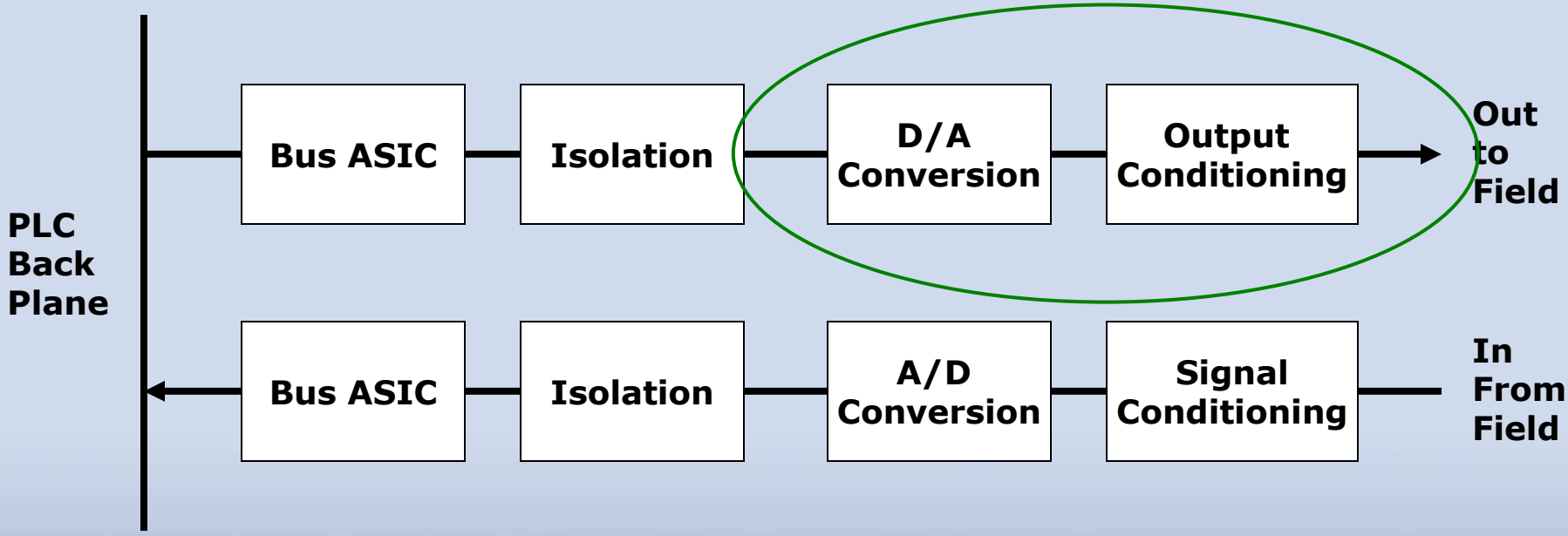


The full 3-cell “CitroMAX” Pack

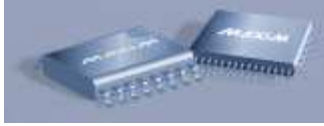
- Voltage = 2.9V
- Current possibly as much as 100uA
- Total Capacity unknown



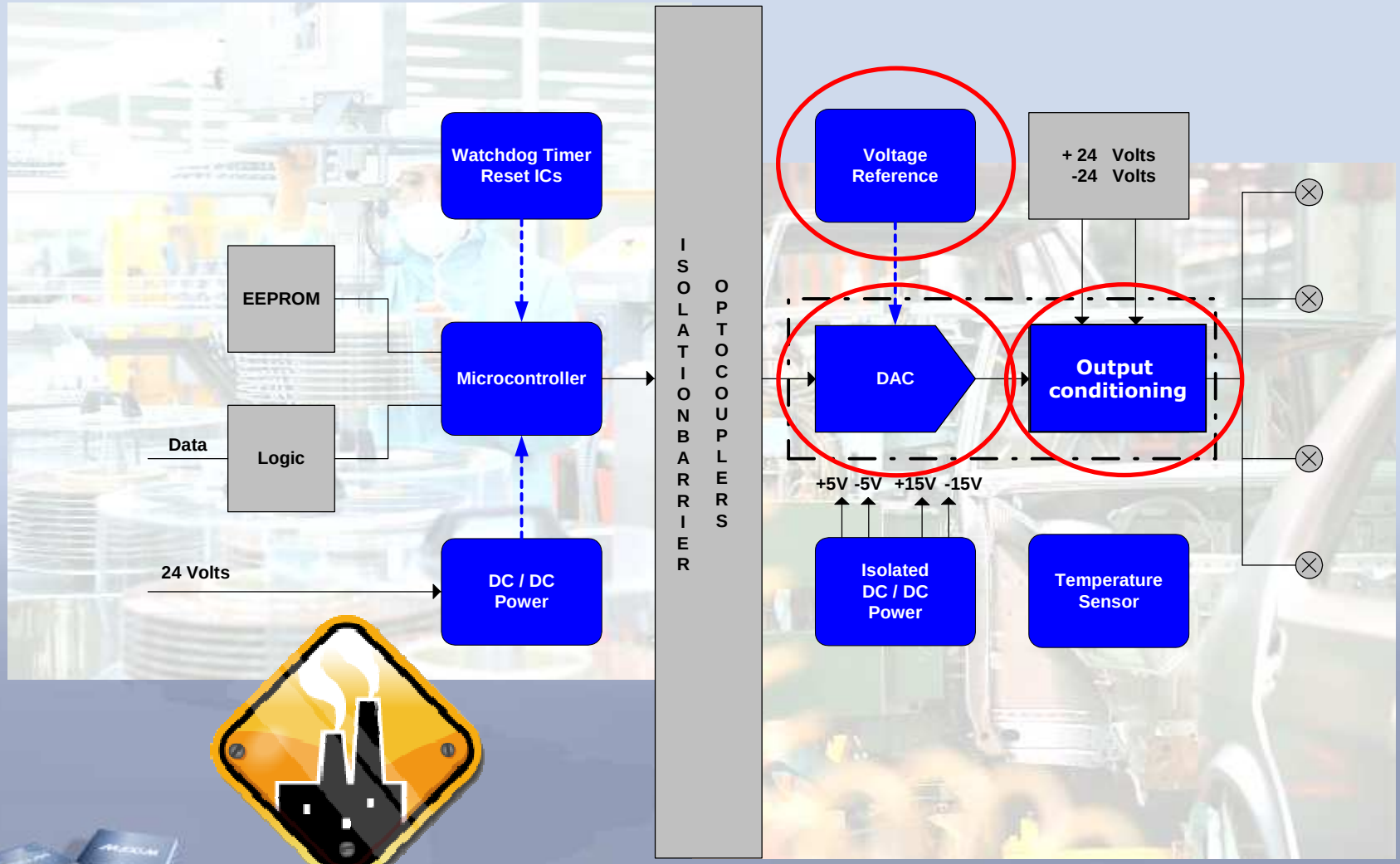
Industrial Automation



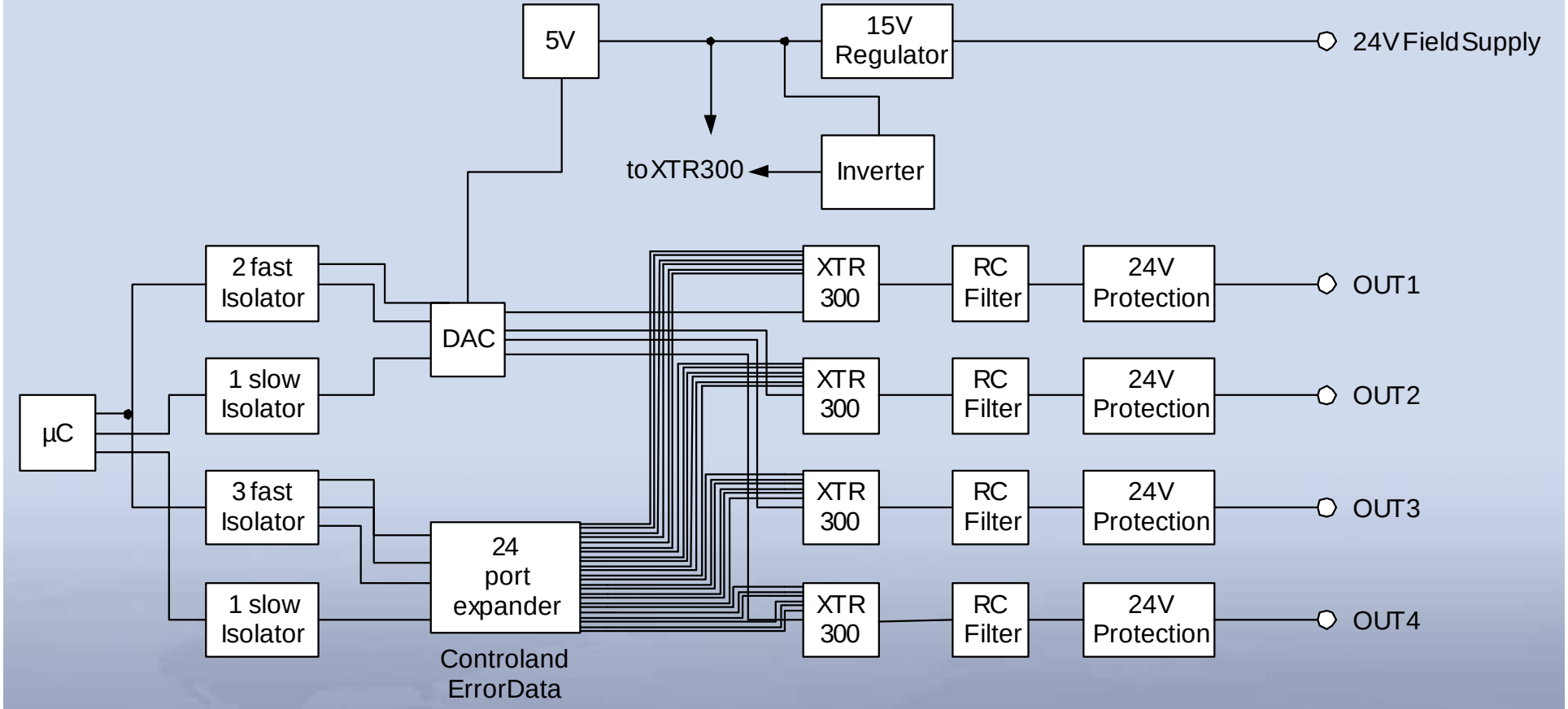
Industrial Analog Output Modules
Industrial Instrumentation
Process Control
Programmable Logic Controls



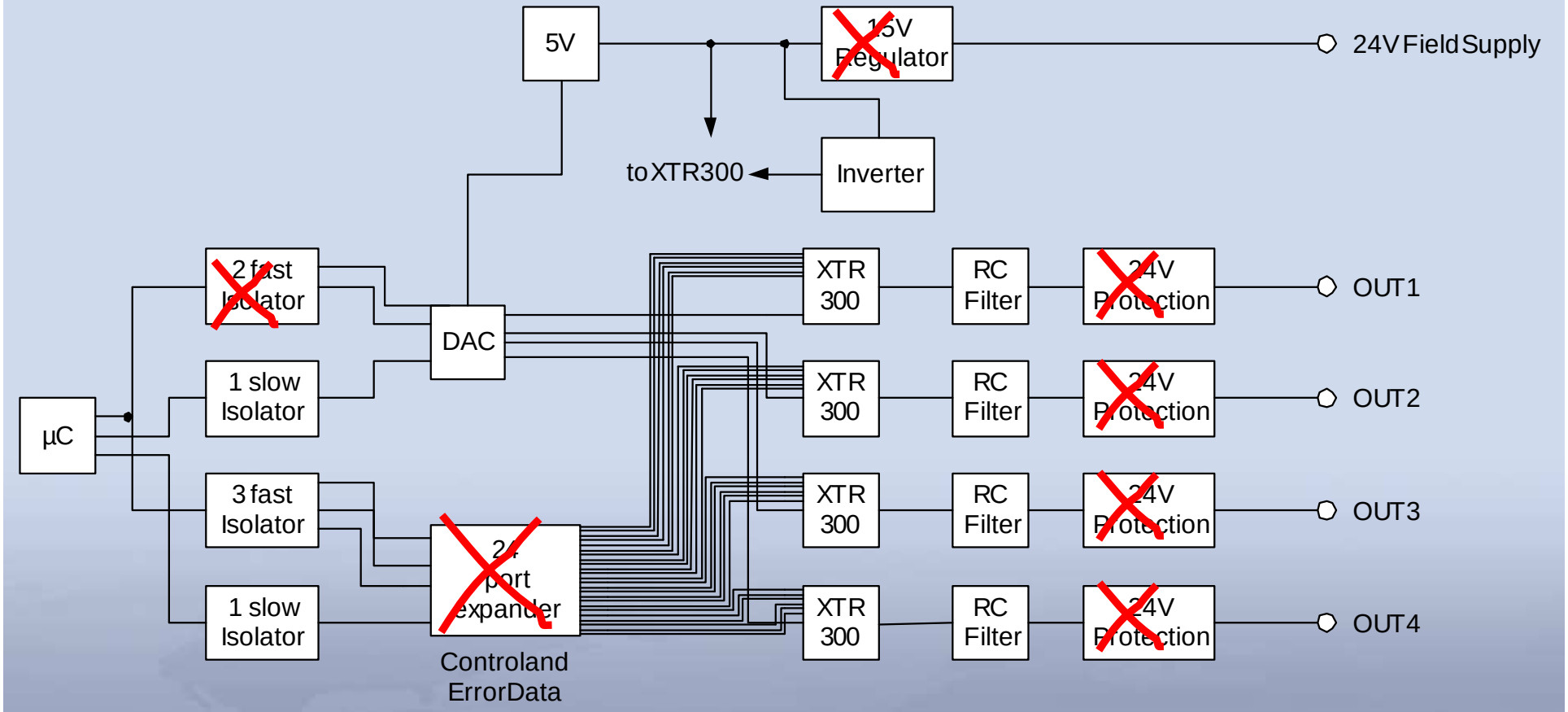
Sockets within an Analog Output

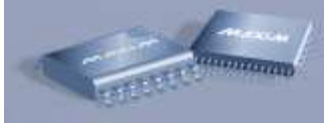


COMPETITION



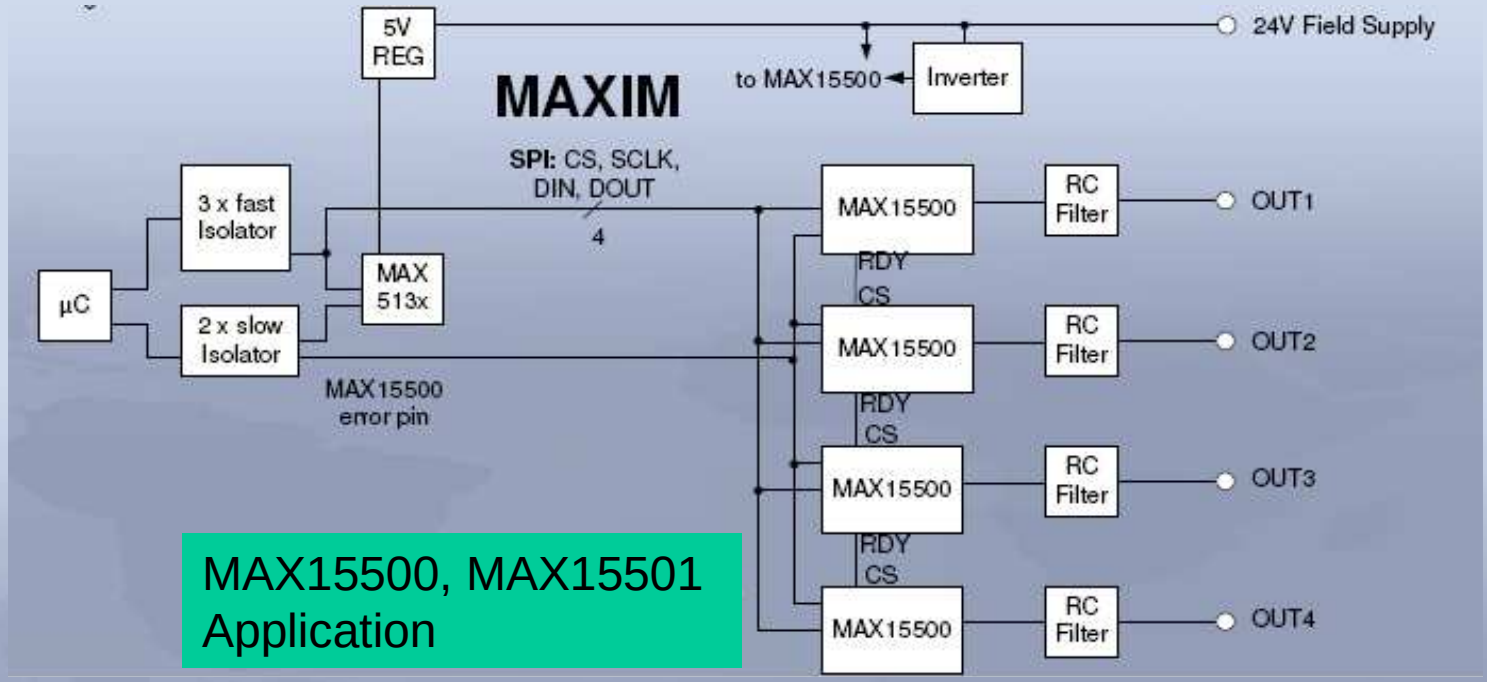
What we do not need



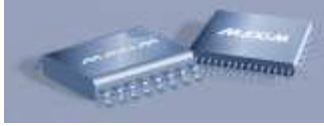


MAXIM

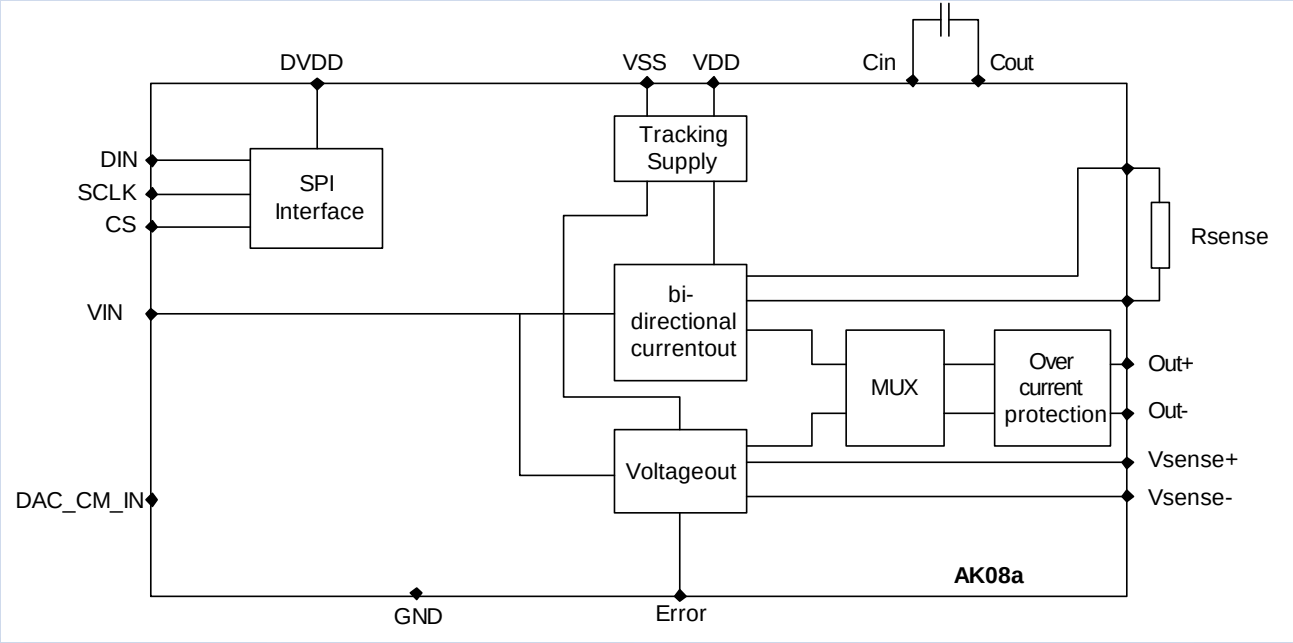
Maxim Product Fit
Group Isolated Industrial Analog Output



MAX15500, MAX15501 Application



MAX15500, MAX15501 - Output Conditioner



- **Minimized power dissipation, using tracking power supply**
- **± 12 V force sense output into 1 kΩ**
- **± 24 mA into 750 Ω**
- **Over Current protection**
- **0.1 ms settling time to 14 bit**
- **40 µs settling time to 12 bit**

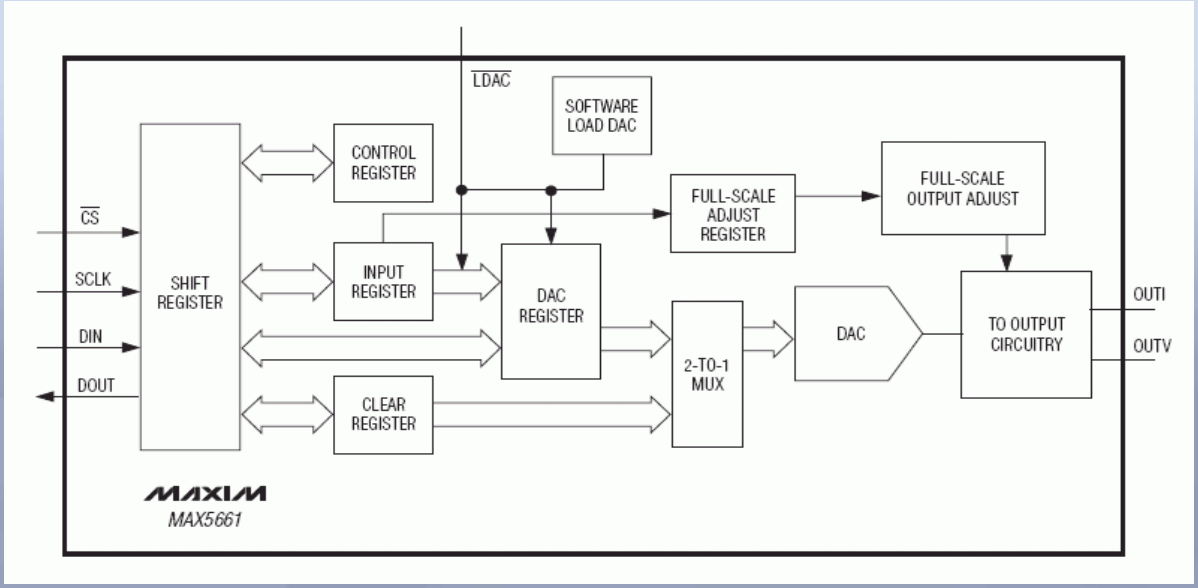
MAX15500 MAX15500 PLC Output Conditioner

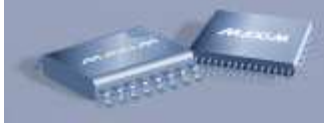
- Power Supplies Operate from 24V Industrial Field Supply
  - Saves additional hardware
  - Survives ±35V Powered or Unpowered
  - Saves additional hardware
- Supports 4.096V & 2.5V DAC Output Signals
  - Easy design reuse
- Ready\ Output for Daisy Chaining
  - Saves 1 digital isolator per channel
- DOUT for configuration read back
  - Additional operation safety
- Extensive error reporting
  - Additional operation safety
- Current Output Drives >>750Ω
- Voltage Output Drives 1kΩ

MAX5661 16-Bit DAC with Current and Voltage Outputs for Industrial Analog Output Modules

MAX5661 Applications

- **Industrial Analog Output Modules**
- **Industrial Instrumentation**
- **Process Control**
- **Programmable Logic Controls**
- **Distributed Control Systems**
- **Motor Control analog outputs**
- **Power grid analog outputs**
- **4-wire sensors**





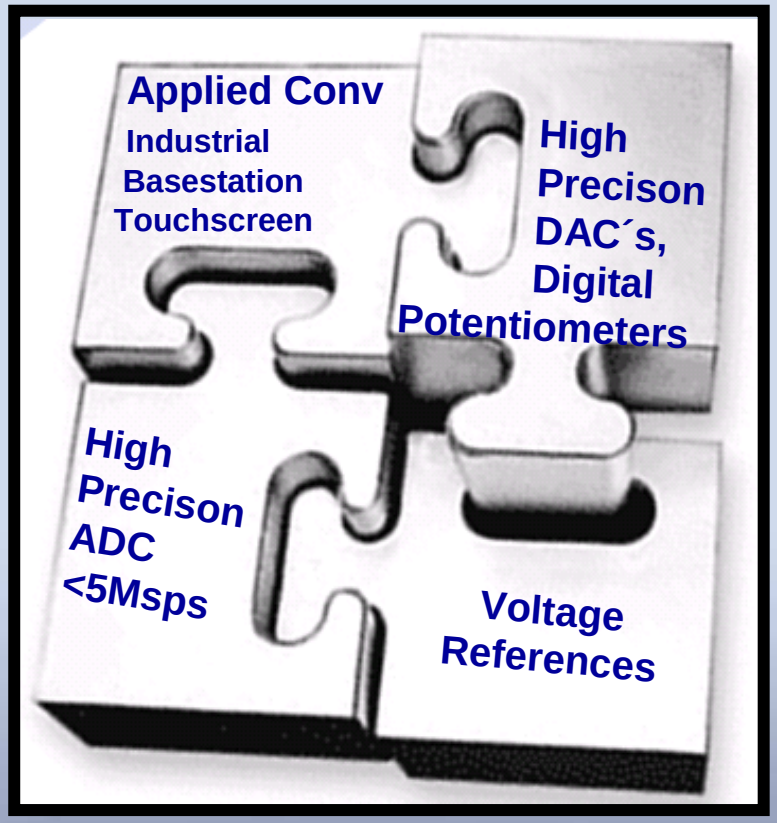
MAX5661 - for Industrial Analog Output Modules

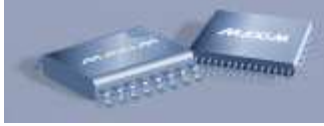
- 10-Bit Programmable Full-Scale Output Adjustment for Up to ±25% Over Range
- Programmable Voltage Output
- Unipolar Range: 0 to +10.24V ±25%
- Bipolar Range: ±10.24V ±25%
- Programmable Current Output
- Unipolar Low Range: 0 to 20.45mA
- Unipolar High Range: 3.97mA to 20.45mA
- Flexible Analog Supplies
- ±13.48V to ±15.75V for Voltage Output
- +13.48V to +40V for Current Output
- Force-Sense Connections (Voltage Output) for Differential Voltage-Output Remote Sensing
- Voltage-Output Current Limit
- Dropout Detector Senses Out-of-Regulation Current Output
- Active-Low CLR and Active-Low LDAC Inputs for Asynchronous DAC Updates
- Active-Low CLR Input Resets Output to Programmed Value or Zero Code
- Active-Low FAULT Output Indicates Open-Circuited Current Output, Short-Circuited Voltage Output, or Clear State
- Temperature Drift
- Voltage Output: ±0.4ppm FSR/℃
- Current Output: ±7.9ppm FSR/℃
- Small 64-Pin LQFP Package (10mm x 10mm)

Applied Converters

Product Lines

- **Sensor Digitizers**
- **AFE's for (Portable) Medical Products**
- **Industrial Automation**
- **Powerline Communications**
- **Bias Controllers for Wireless Infrastructure Power Amplifiers**
- **Flat Panel Products/Touch-screen Controllers**



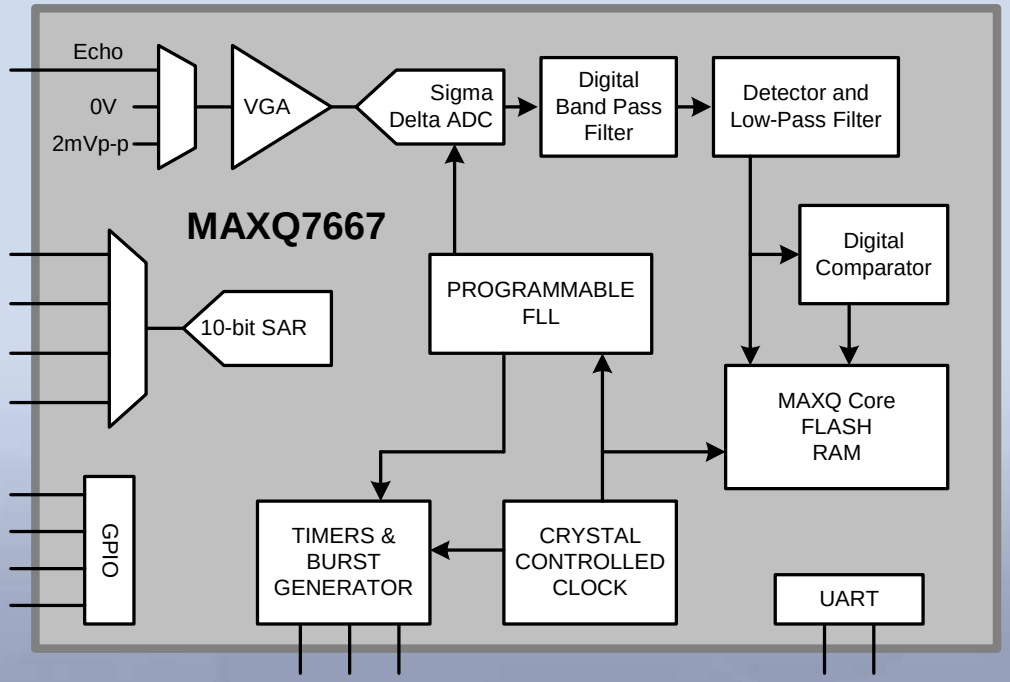


MAXQ7667: A Single-Chip Solution for Ultrasound

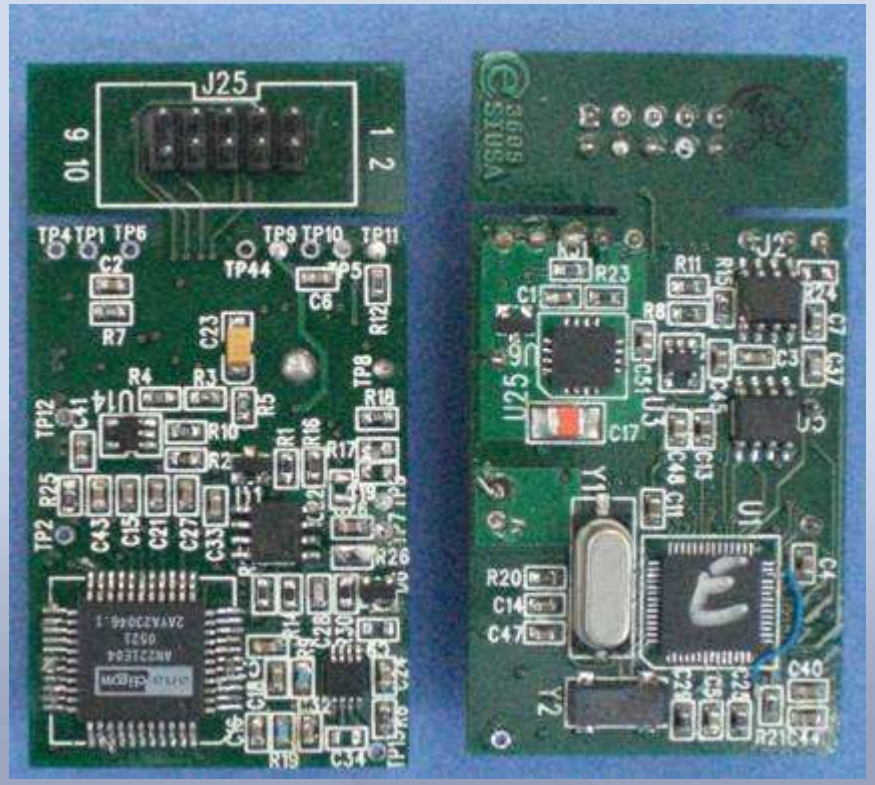
Analog intensive general purpose micro

Contains:

- **High precision Sigma Delta and SAR ADC**
- **DAC for Burst generator for pulse transmission**
- **High percision LNA, PGA, band-pass filter, demodulator, low-pass filter (Echo receive path)**

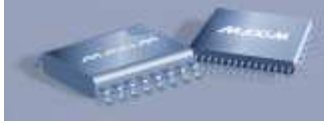


MAXQ7667: A Single-Chip Solution for Ultrasound



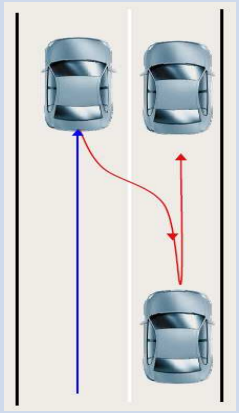
MAXQ7667

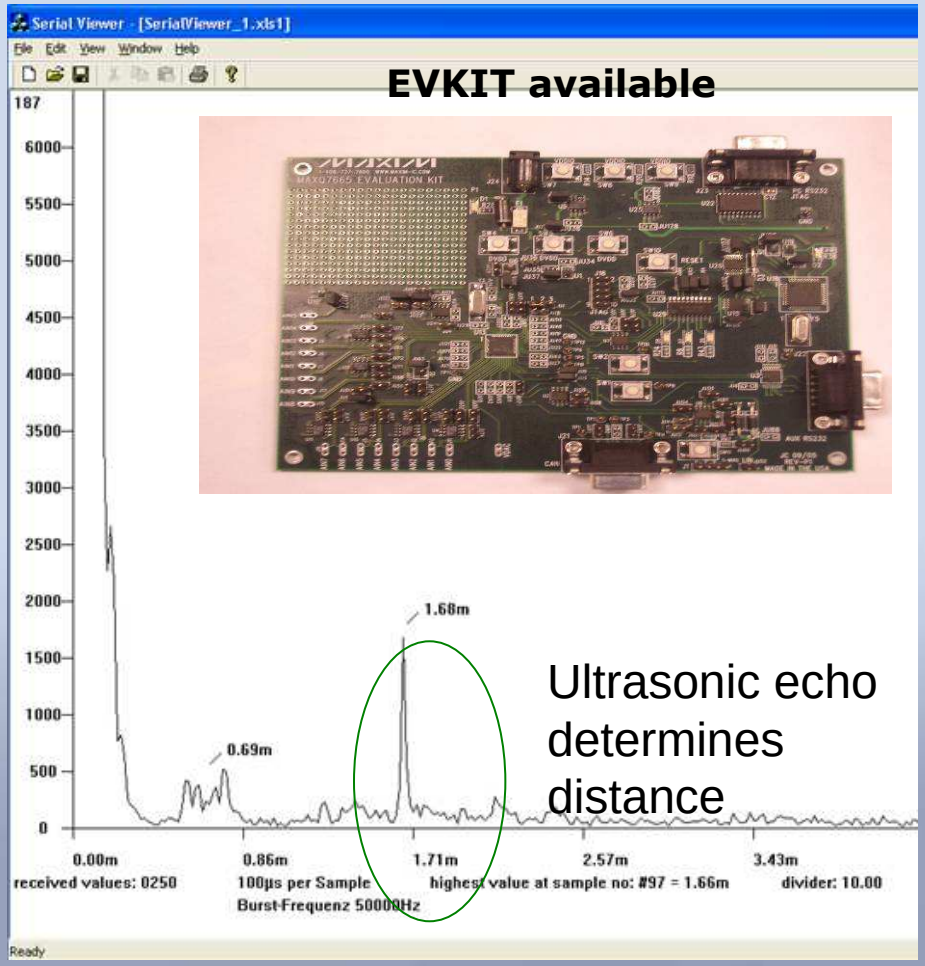
Device outputs distance data on serial interface.
Accuracy: ~1 cm
Max distance: ~5 meter
Min distance: ~20-25 cm

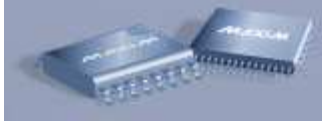


Ultrasonic Applications

- Electronic parking assistance
- Obstruction detection
- Video games and simulations
- Light activation
- Security / intrusion detection (electronic fence)
- Electronic distance metering
- Aid to visually impaired
- Object detection
- Toilet and faucet activation
- Building controls
- Level metering
- Night vision assistance





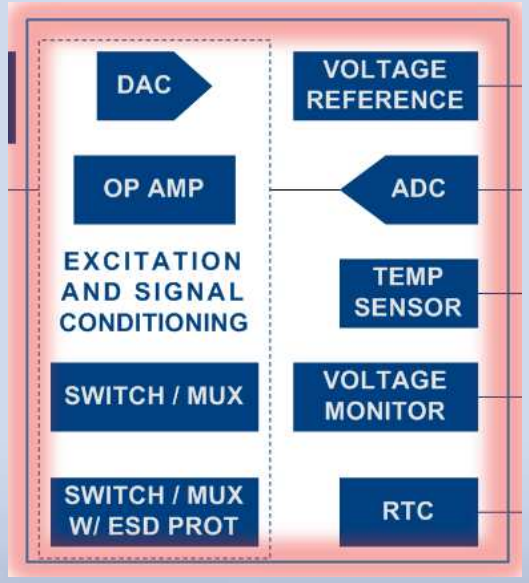


Portable Medical

‘Applied Converters’ group provides signal processing AFE

Target Applications:

- **blood glucose meters**
- **Digital X-ray**
- **Medical electronics**
- **Electro-chemical sensors**
- **Portable equipment**
- **Industrial control systems**
- **Other Applications: any equipment requiring a low-power high-resolution AFE**

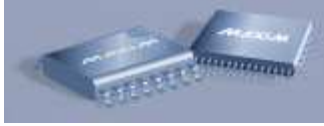


Blood Pressure

Pulse Oximetry

Temperature

Blood Glucose



MAXIM

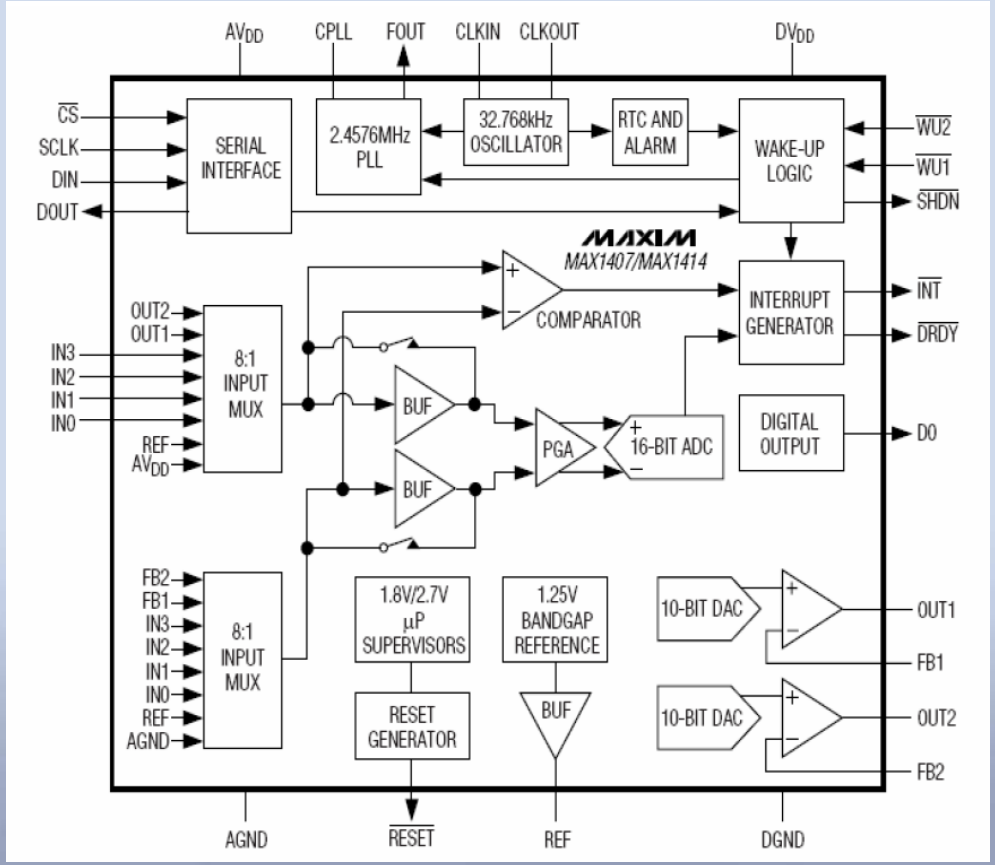
MAX1407/1408/1409/1414: 16-bit Σ–Δ ADC Smart Data Acquisition System

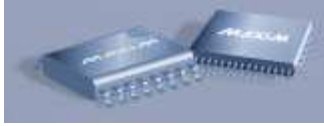
Applications

- **Medical electronics**
- **Electro-chemical sensors**
- **Portable equipment**
- **Industrial control systems**

Features

- **16-bit 50/60sps S-D ADC**
- **Dual 10-bit force/sense DAC's**
- **4 external ADC inputs, 1 digital UPO**
- **1.8 & 2.7V voltage supervisors**
- **32 kHz oscillator, RTC,2.5 MHz PLL clock**
- **28/20 pin SSOP package**





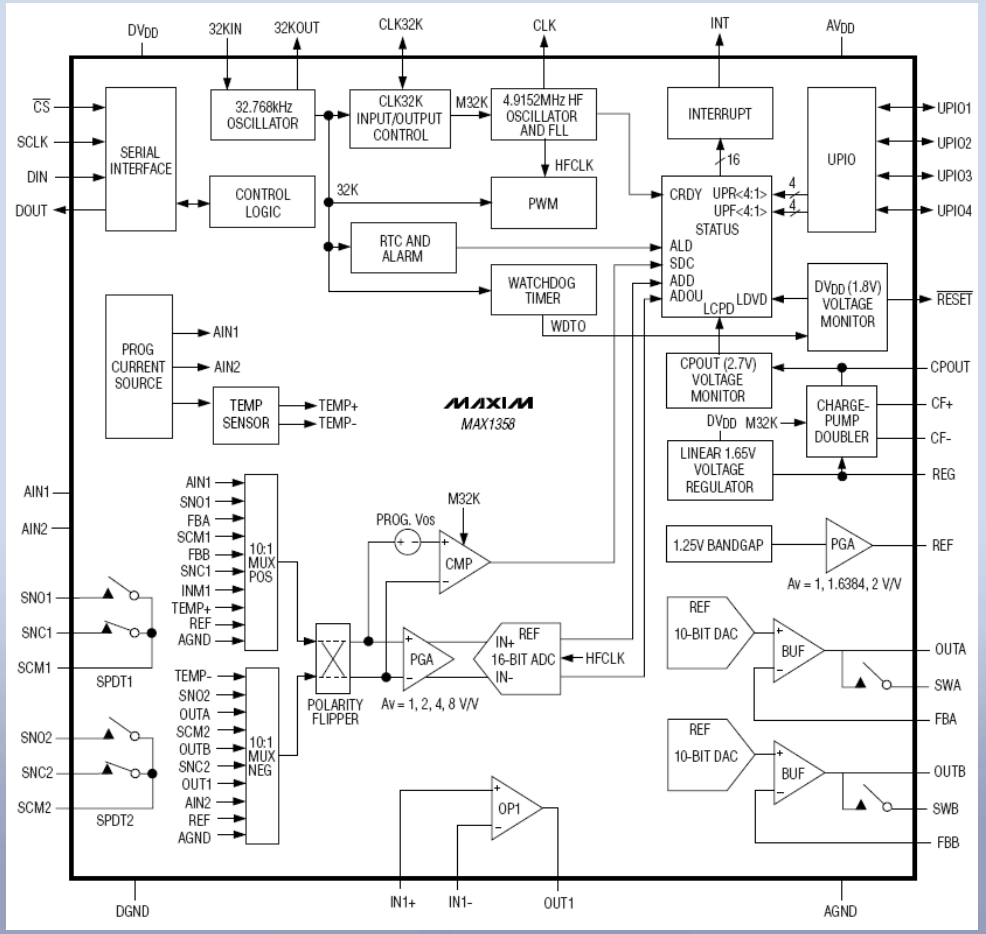
MAX1358/1359/1360:
16-bit Σ–Δ ADC Smart Data Acquisition System

Applications

- **Electrochemical sensors**
- **Photo-optical instruments**
- **Battery powered devices**

Features

- **16-bit 10-500sps S-D ADC**
- **Dual 10-bit force/sense DAC's**
- **Dual SPDT analog switches**
- **2 analog inputs, 4 digital IO's**
- **Uncommitted opamp**
- **Local/remote temperature sensors**
- **32 kHz oscillator, RTC, 5 MHz FLL clock**
- **40-pin TQFN package (6x6 mm)**



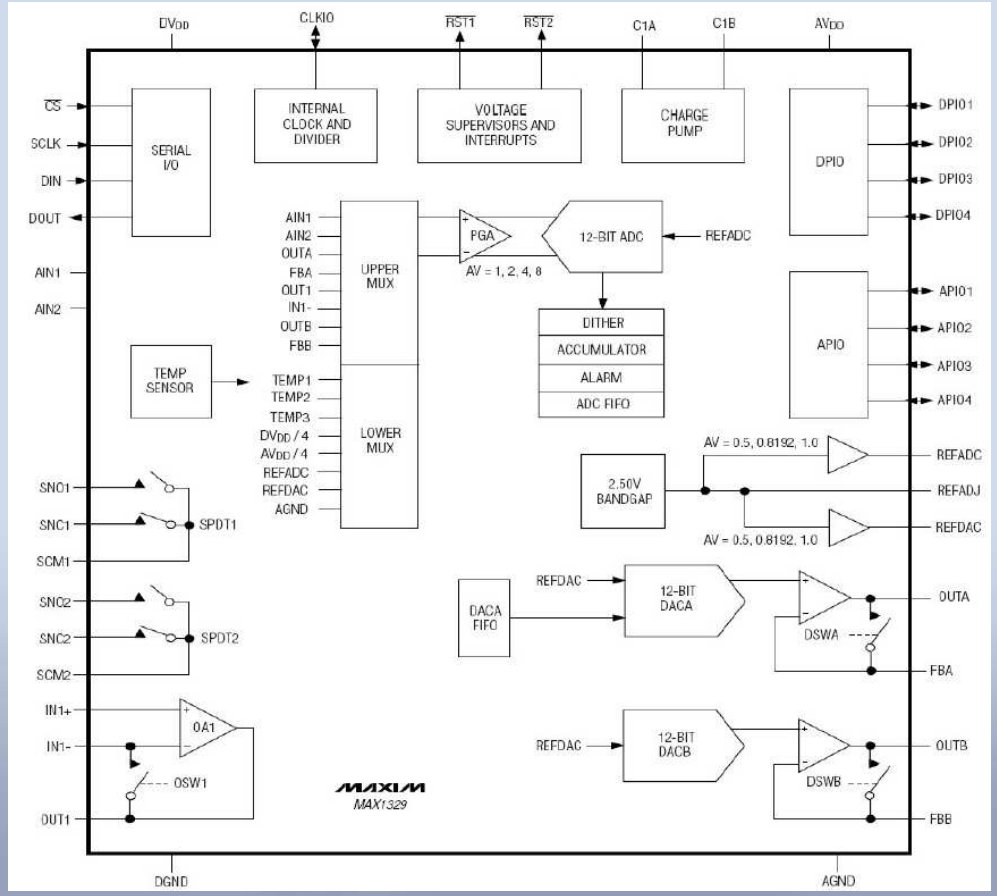
MAX1329/1330/1331: 12-bit SAR ADC Smart Data Acquisition System

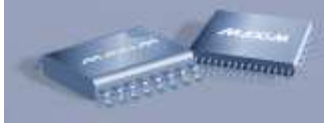
Applications

- **Electrochemical sensors**
- **Photo-optical instruments**
- **Portable equipment**
- **AC measurement systems**

Features

- **12-bit 230ksps (16 bit 0.9ksps) SAR ADC**
- **Dual 12-bit force/sense DAC's**
- **Opamp, dual SPDT analog switches**
- **Local/remote temp sensor**
- **4 digital IO's, 4 analog IO's**
- **40-pin TQFN (6x6mm) package**



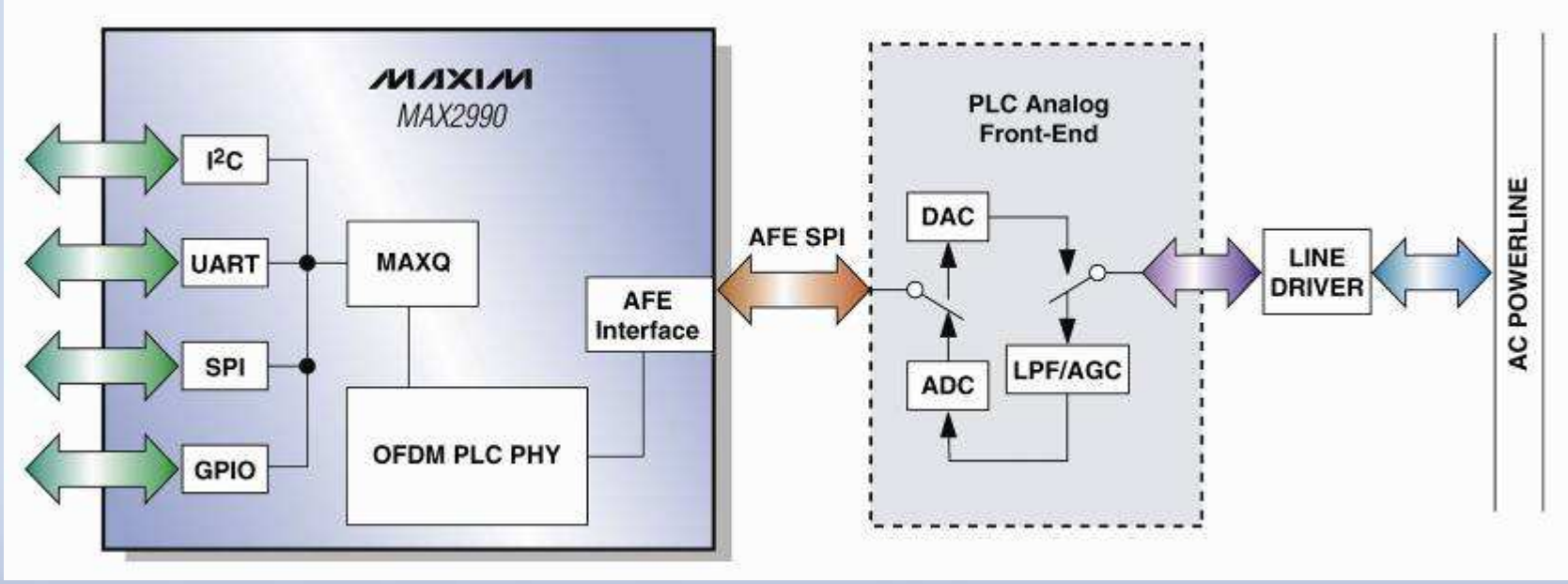


MAX2990 OFDM power line modem

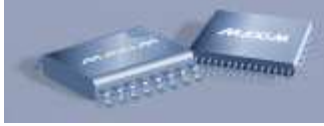
“Industry’s First Broadband Power Line Communication Modem Delivers up to 100 Kbps effective data rate in 10kHz–490kHz Frequency Bands”

IN FULL PRODUCTION

Powerline Block Diagram



The complete OFDM modem application circuit consists of the baseband the analog front end and line driver



MAX2990 Main Features

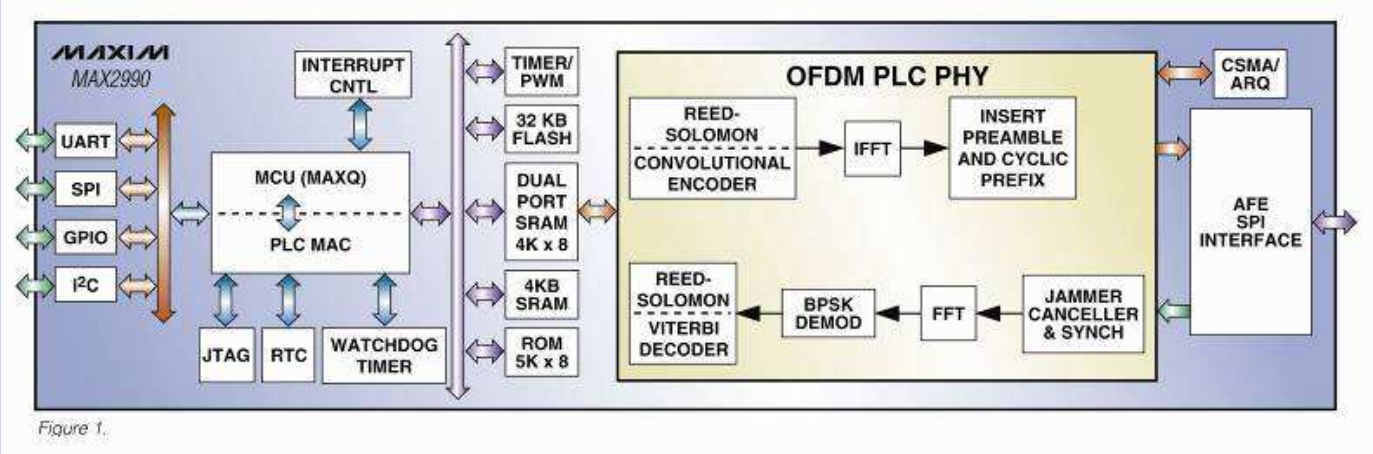
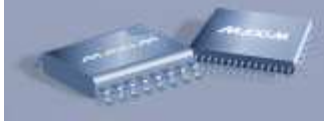


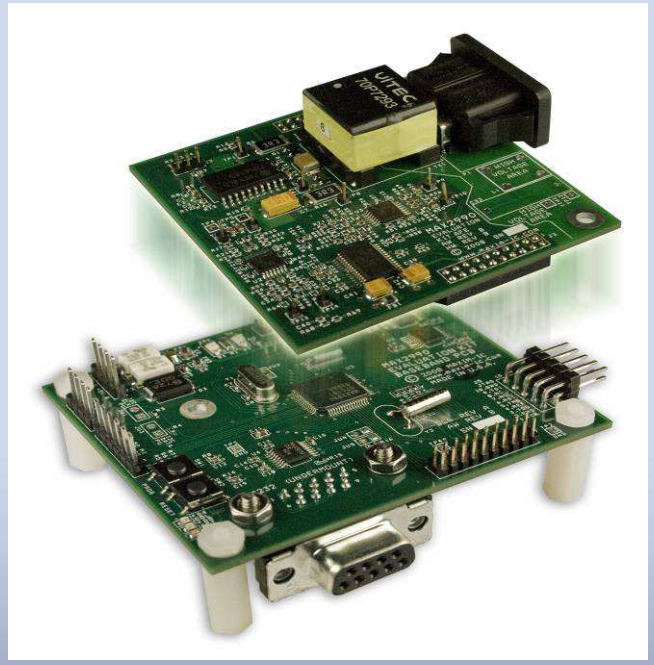
Figure 1.

- Combines the Physical Layer (PHY) and Media Access Controller (MAC)
- Integrated Microcontroller with 32K Bytes Flash Memory and 4K Bytes SRAM
- Max Effective Data Rate In Normal Mode: 32kbps at 10kHz - 95kHz and 100kbps at 10kHz - 490kHz
- Complies with:
  - CENELEC (10kHz- 140kHz)
  - FCC (10kHz-490kHz)
  - ARIB (10kHz-450kHz)
- User programmable frequency selection allows user to define the start-end frequency to be used for data transmission
- Includes Forward Error Correction (FEC) Mechanism and CRC16
- Includes Fast DES Engine as the Encryption/Decryption Coprocessor
- Carrier Sense Multiple Access/Collision Avoidance (CSMA/CA) Channel Access Arbitration
- Automatic Repeat Request (ARQ) in Order to Enhance Error Detection and Improve Data Reliability



EV-KIT AVAILABLE

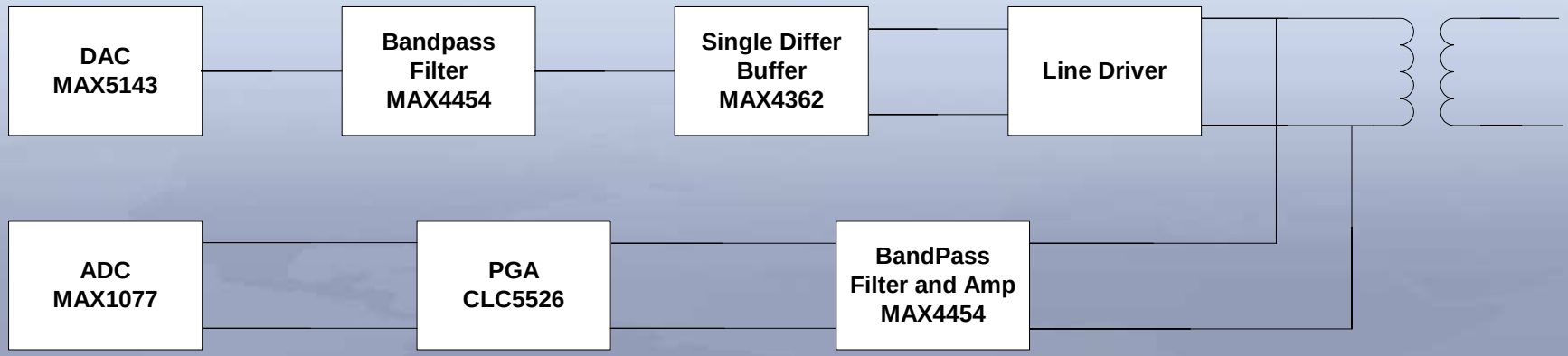
- Complete PLC modem transceiver designed to fully evaluate the MAX2990 performance.
- NEW DISCRETE ANALOG FRONT END DESIGN is currently in validation .
- NEW EV-Kit will be available March 09



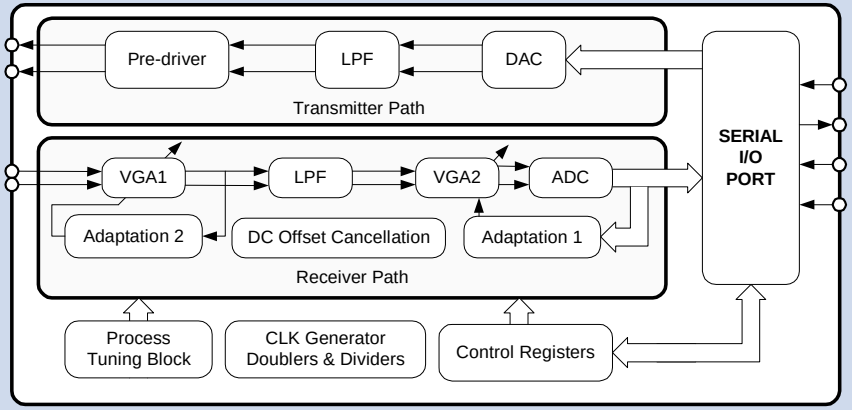
Discrete Analog Frontend

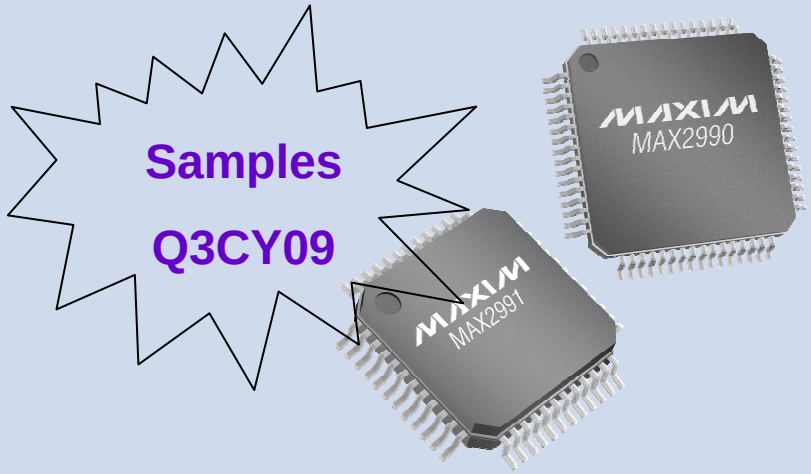
- 30 dB Dynamic Range
- ~0.2 W output power
- Digital Control of Tx and Rx Path
- Line Driver and coupling circuit optimized for power line impedance matching

AFE DESIGN

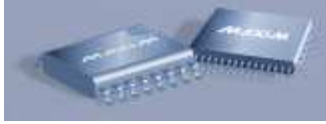


Integratd AFE MAX2991



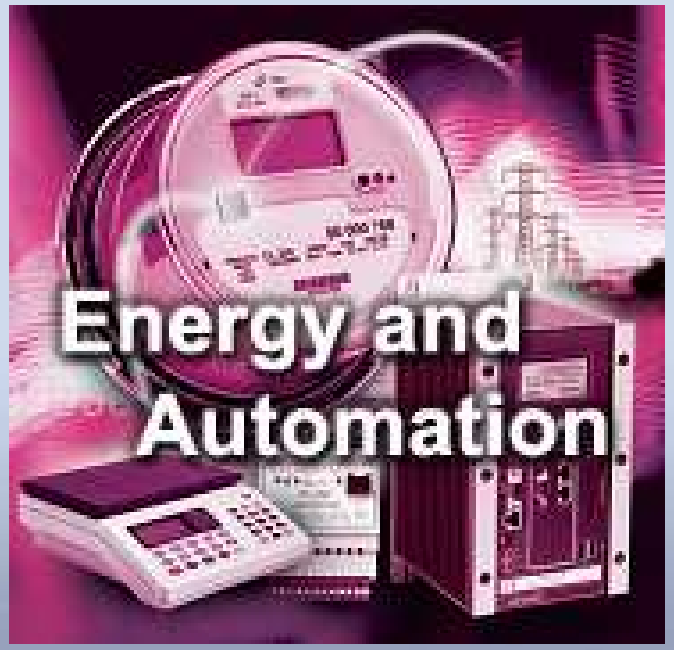


- Complete Analog Front-End (AFE) and companion chip to MAX2990 baseband to form a full PLC modem chipset
- Greatly reduces the total BOM count and cost
- On chip band select filter, VGA, SD ADC for the Rx path
- On chip band waveform shaping filter, programmable predriver and, SD DAC for the Tx path
- Built in 60 dB Dynamic Range AGC and DC offset cancellation
- Programmble Filters to comply with CENELEC (9-95 & 95-125 & 125-140 Khz), FCC (9-480 Khz) and ARIB (9-450 Khz) Transmit Mask

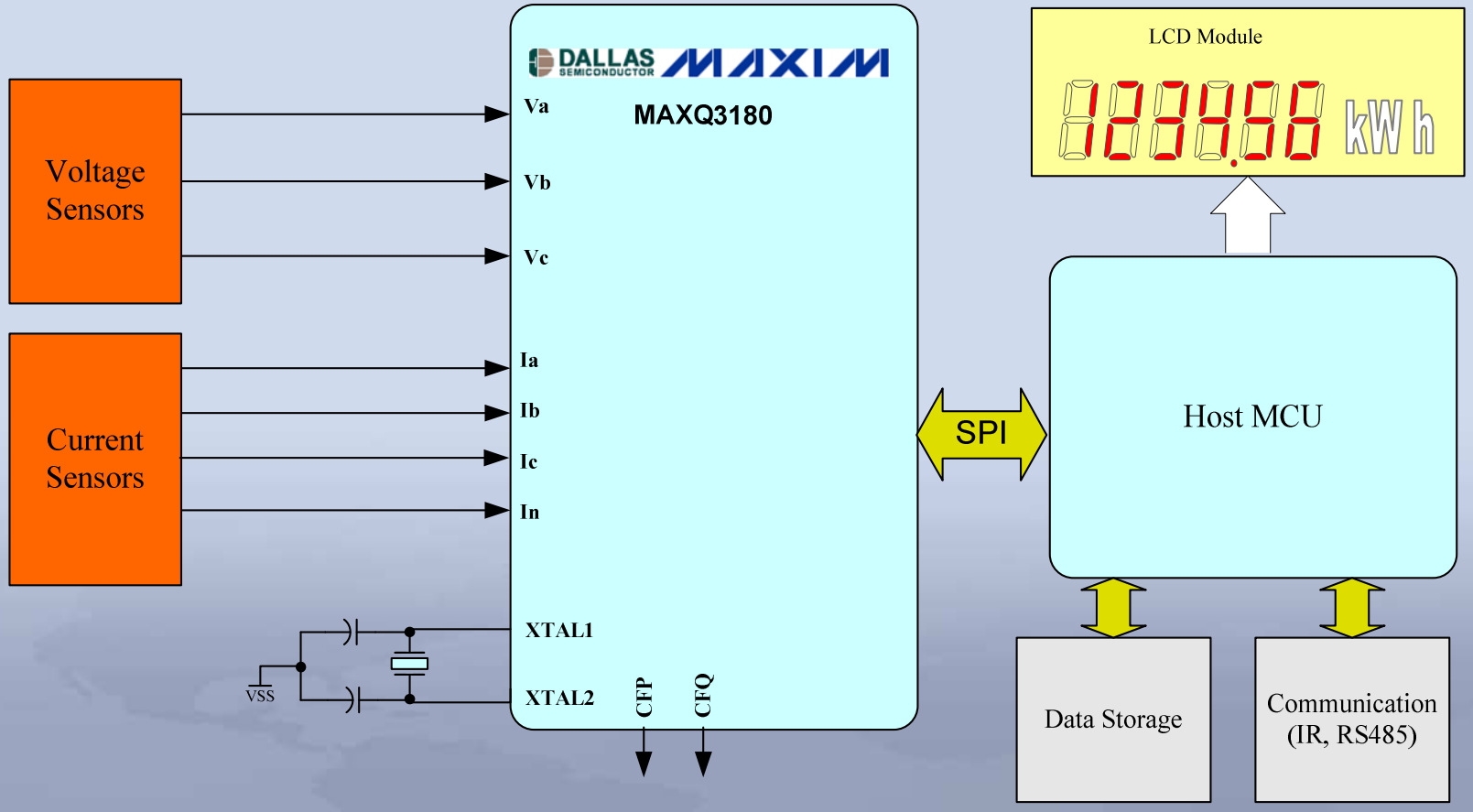


MAX2990 Target Markets/ Applications

- Automatic Meter Reading (AMR)
  - **Tariff control and rate adjustments**
  - **Load management (data acquisition and control)**
- Building Automation
  - **HVAC (heating, ventilation, and air conditioning)**
  - **Lighting Control**
  - **Key entry access control**
- Traffic management
  - **Street light management**
  - **Airport runways**
- Home Automation
  - **Smart (Networked) Appliances**
- Industrial Automation
  - **Remote monitoring and control**



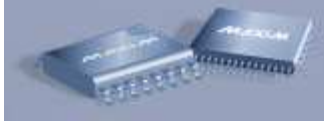
MAXQ3180 - Application Circuit



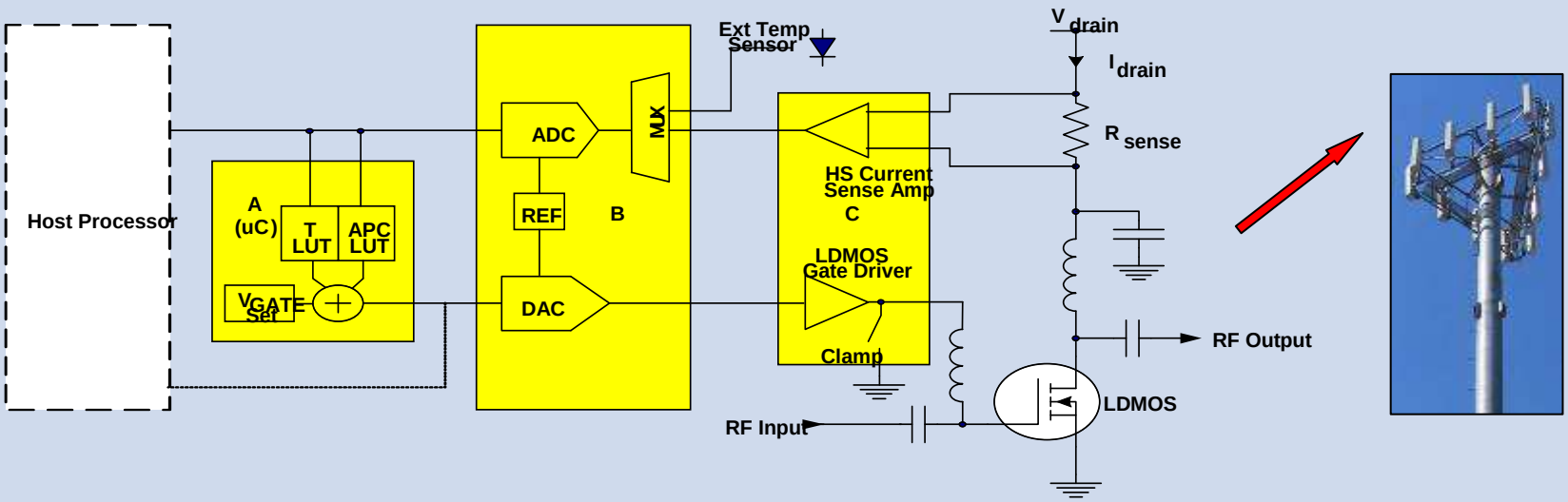
Maxim Energy Metering - Reference Solution

Features:

- **MAXQ318x Processor**
- **3-phase multi-function meter (active energy, reactive energy, RMS, power factor, line frequency, phase sequence error detection…)**
- **RS232 and RS485 communication**
- **LCD**
- **RTC**



Power Amplifier Biasing Control



Part No.	Feature	Description
MAX1350-57	C	High Side Sense Amplifier and Gate Driver Amplifier
MAX1020 - 1258	B	Multi-channel ADC, Octal DAC, temperature sensor and configurable GPIOs
MAX1385	B+C	Dual RF LDMOS Bias Controller. High-side current sense, LDMOS drive, ADCs, DACS, temp monitoring.
MAX11008	A+B+C	Complete Dual RF LDMOS Bias Controller. High-Side Current sense, LDMOS drive, ADCs, DACS, temp monitoring. EEPROM to store calibration variables.
MAX11014		Provides NEGATIVE bias for MESFET (NOT LDMOS) applications.

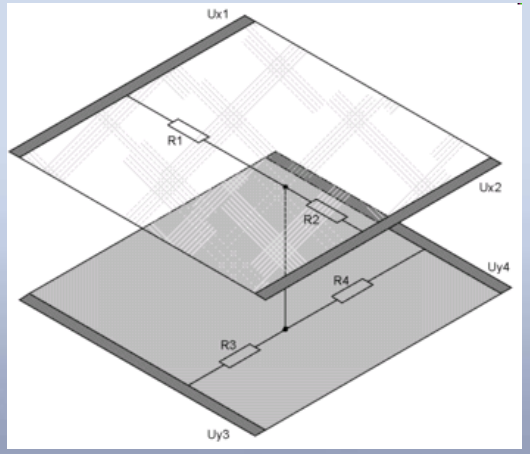
Touchscreen Controller

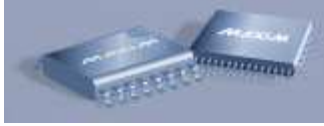
- **90% of TSC market is based on resistive technology**
- **Capacitive has a small share, but is rapidly growing**
  - **Resistive TSC is lower cost than capacitive**
  - **Resistive TSC allows multiple methods of data entry: finger or stylus**
  - **Resistive Well-understood, mature technology**

MAXIM today is in the RESISTIVE 4 WIRE touch screen market

PARTS that are available

- *MXB7843 / MXB7846* Industry Standard TSC with 15kV ESD Protected
- *MAX1233 / MAX1234* TSC + Keypad Decoder / GPIO / System Monitor





Where are they used

Touch-screen controllers are everywhere!

Automotive

Consumer

Gaming

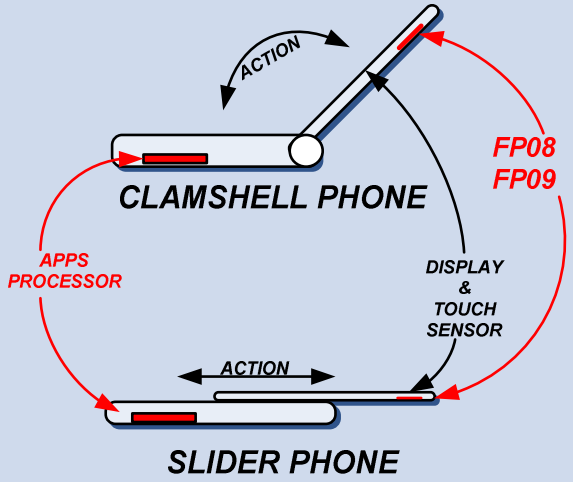
Transportation, Financial, Retail

Industrial

MAX11800 MAX11810
(MAX11800+Haptic+Proximity sensor)

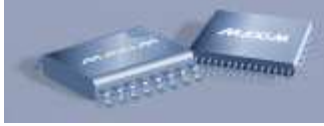
MAX11800

- Low Power
- Space Saving Resistive TSC
- Reduced Interrupts
- Averaging / Autonomous Modes
- Reduced Data Transfer
- Eliminates the Need to Route Analog Signals Through the Hinge or Sliding Contacts



MAX11810

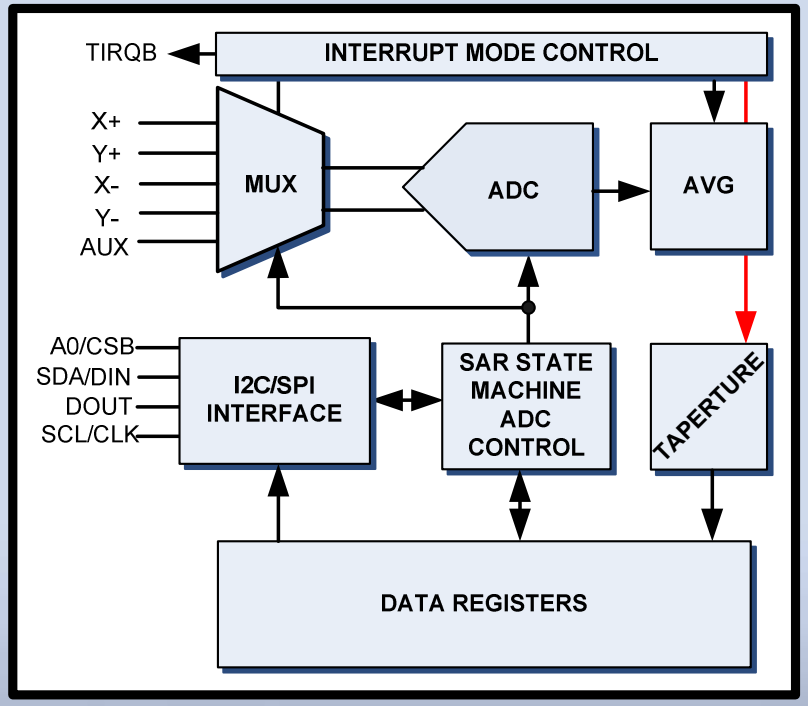
- HAPTIC FEEDBACK FUNCTION:
  - The User “Feels” The Display
  - Separates The Two Touch Events:
    - Touch to Feel
    - Touch to Execute

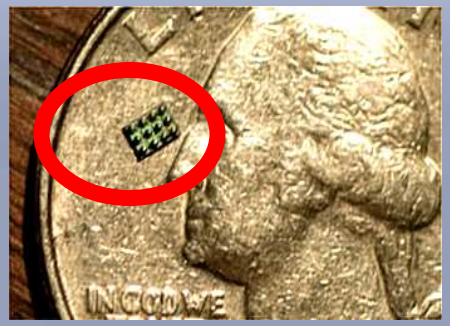


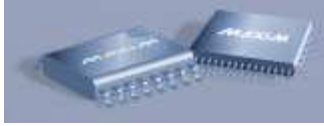
MAXIM

MAX11800 Ultra small / Low Power TSC

- +1.8V and +3V Single Supply Operation
- 12-Bit Resolution
- Lowest Power Operation in Industry
- Advanced Interrupt-Driven Operation Modes
- X / Y Coordinate Measurement
- Touch-Pressure Measurement
- 4 Wire Resistive Touch-Screen Interface
- Ratiometric Conversions
- 25MHz SPI Serial Interface
- 400kHz I2C Interface
- Space saving 1.6mm X 2.2mm 12-pin WLP Package

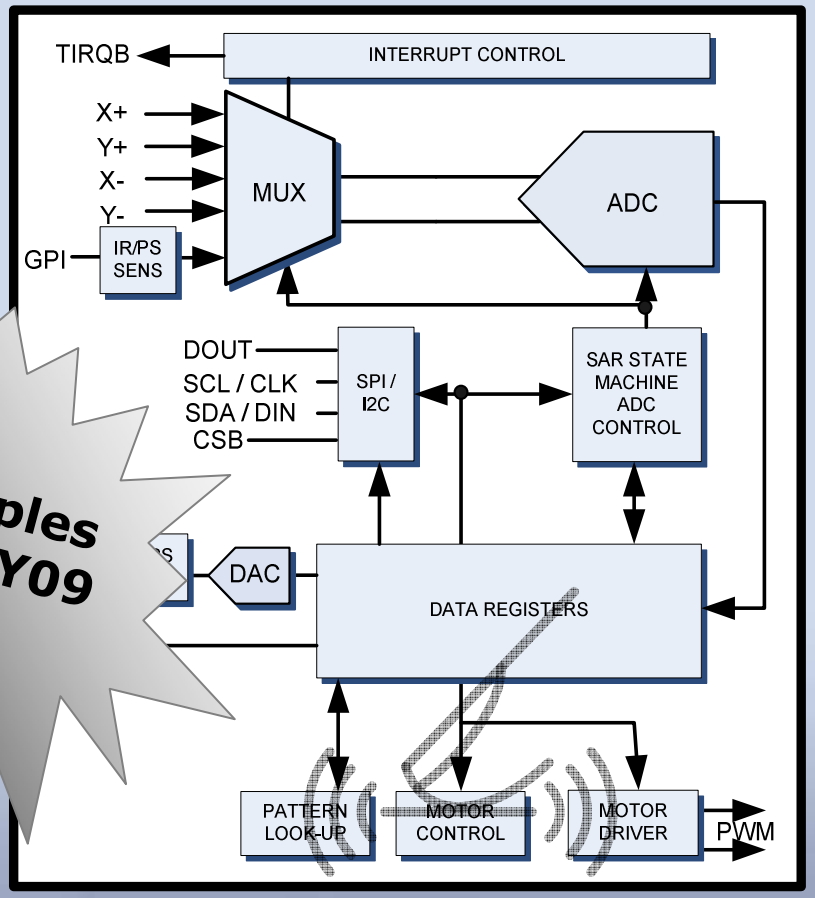






MAX11810
TSC + HAPTIC FEEDBACK & PROXIMITY SENSOR

- +1.8V to +3V Single Supply TSC
- IR-Based Driver and Proximity Sensor Eliminates False Activation of the Touch Sensor
- Drives 1.8V or 3V Coin or Offset Load Linear Motors
- X / Y and Pressure Measurement
- SPI™or I2C Serial Interface
- Low Power
- Reduced Interrupts
- Reduced Digital Interface Activity
- Spatial Filtering
- 2mm X 2mm UCSP Package
- Low Power Drive Mode to Mate with FP05 for Driving Multi-Layer Piezo Actuators



Samples Q2 CY09

- Smallest TSC to Integrate Actuator Driver and IR Sensing
  ENABLES HAPTIC (TACTILE) FEEDBACK
  ADDS THE “FEEL” COMPONENT TO USER EXPERIENCE
  ENABLES LOCATING FEATURES ON SCREEN.

Thank You